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College of Science



**Environment and Sustainable
Development program**

**Towards Environmentally Sustainable Interior Design
(ESID): Studying Eco-friendly Interior Materials and the
Efficiency of Selected Indoor Plants Toward Remediation**

A Thesis Submitted in Partial Fulfilment of the Requirements
for the PhD Degree in Environment and Sustainable
Development

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- ☐ Without making any changes to the thesis.
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Abstract

In recent years, there has been a noticeable trend in the interior design sector towards creating interior-built environments that prioritize both health and sustainability. This shift, termed as environmentally sustainable interior design (ESID), depends heavily on the careful selection of eco-friendly interior materials (EFIMs) and suitable indoor plants. Consequently, the study was conducted on EFIMs available in the local market of Bahrain. A sample of n=30 local stores supplying interior finishing materials was selected for the study. Data were collected via five methods. Firstly, a review of existing EFIMs. Secondly, the availability of EFIMs was observed through a non-participatory approach. Thirdly, a survey of EFIMs supplied in the Bahraini market was also carried out. Fourth, a semi-structured interview with retailers, final and fifth, semi-structured interview with local interior designers was scheduled. Data were collected and processed using Microsoft Excel program. In the context of phytoremediation, formaldehyde purification experiments have been performed by selecting three indoor non-native plants namely, *Epipremnum aureum* (Pothos plant), *Chlorophytum comosum* (Spider plant), and *Spathiphyllum wallisii* (Peace lily). Sensors and real-time instruments IQ-610 direct sense probe was used. Data were processed and statistical analysis (ANOVA test) has been performed for the data. The results of the EFIMs study show 70% of suppliers have stocked EFIMs with a total of sixty-three EFIMs which were collected and identified. Among them, 67% of EFIMs were categorized as flooring finishes followed by wall finishes (25%) and ceiling finishes (8%). The majority (80%) of the interviewed interior designers did not use EFIMs and stated that their clients did not request EFIMs for their projects. All the interviewed interior designer agreed that clients are not aware of the importance of EFIMs. The results of the HCHO phytoremediation experiments for single potted plants revealed that the most efficient plant was *S. wallisii*, followed by *E. aureum*, and *C. comosum* 73.0, 71.5, and 71%, respectively. While the HCHO phytoremediation for 2 identical potted plants revealed that the most efficient plant was *E. aureum*, followed by *S. wallisii*, and *C. comosum* 77.5, 74.6, and 73.0%, respectively. It is recommended to continuously design, and supply EFIMs, to initiate awareness programs for public, and to include EFIMs knowledge in educational curriculums. Interior designers are recommended to search and apply updated EFIMs in their projects. It was also recommended to test similar plants in real environments for a long time and expose them to different air pollutants.

Publications

1. **Abeer Ahmed Khalifa**, Ezzat Khan and Muhammed Salim Akhter (2023) “Phytoremediation of indoor formaldehyde by plants and plant material” International Journal of Phytoremediation, 25(4), 493-504. doi:10.1080/15226514.2022.2090499
2. **Abeer Ahmed Khalifa**, Dalal Alalaiwat and Ezzat Khan (2024) “phytoremediation of formaldehyde by three selected indoor potted non-native plants species” International Journal of Phytoremediation, In press. doi:10.1080/15226514.2024.2357635

Dedication

To.

my beloved husband

for being with me all the way

my little twins and angels, Jameela, Haya, Ahmed & Rashed

who made me smile :)

my mother& father

for their prayers

my sisters & friends

for supporting and believing in me

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List of Abbreviations

UNEP	United Nations Environment Program
EPA	Environmental Protection Authority
OSHA	Occupational Safety and Health Administration
TWA	Time-weight average
TLV	Threshold limit value
ESID	Environmentally Sustainable Interior Design
EFIMs	Eco friendly interior materials
HCHO	Formaldehyde
VOCs	Volatile organic compounds
SBS	Sick building syndrome
COPD	Chronic obstructive pulmonary disease
IAP	Indoor air pollution
IAQ	Indoor air quality
mg/m ³	Milligram per cubic meter
SDGs	Sustainable Development Goals
USEPA	United States Environmental Protection Authority
PII	Pollution Indication Index
Lux	Unit of illumination
PPED	Photosynthesis photon flux density
PAR	Photosynthesis active radiation
BREEAM	Building research Establishment Environmental Assessment Methods
LEED	Leadership in Energy and Environmental Design
CASBEE	Comprehensive Assessment System for Built Environment Efficiency

Chapter 1 **Introduction on the study**

1.1 Introduction to the study

Initially, this Ph.D. study was oriented toward the assessment of indoor air quality inside office buildings. Targeted air pollutants were VOCs, ozone, CO, CO₂ as they possibly exist inside office environments and are emitted mainly from interior finishing materials, paper products, photocopy machines, printers, etc. (Cattaneo, Spinazzè, & Cavallo, 2022; Nathanson, 1995). Targeting the offices indoor spaces where occupants spent more than one third of their daytime inside air-tight environments that accumulate indoor air pollutants which adversely affect their health, well-being, and productivity.

After purchasing the real-time instruments and sensors, preliminary measuring practices were conducted to measure the concentrations of these pollutants inside some offices and departments. However, results showed no evidence of high concentrations beyond the acceptable range and all readings were within the limits (**Appendix A**).

A strong need to deviate the direction of the project to another trendy, more suitable topic to collect reliable data and come up with distinguished findings that potentially add to the existing knowledge and benefit society. Thus, we opted to study the environmentally sustainable interior design (ESID) because in recent years, the interior design sector has been dramatically shifted from the traditional material to a new strategy that focus on creating healthy sustainable environments for occupants to live in, work, and play. In this study, ESID was targeted via two manners. First, focusing on the study of eco-friendly interior materials (EFIMs) utilized indoor and its properties and environmental impacts from literature in order to create healthy interior spaces by minimizing indoor air pollution (IAP). Interior finishing materials are defined as the final layer appeared on the exposed interior surfaces, ceiling, walls, and floor (Altay & Salcı, 2023) such as plywood, particleboards, vinyl paints, carpet, finished textile that could be conventional materials or eco-friendly options. However, EFIMs are designed to minimize negative effects on people and environment by meeting some or all the following characteristics:

- 1- Use natural or renewable resources.
- 2- Energy and water efficiency.
- 3- Recycled content or can be recycled after usage.
- 4- Durable.

- 5- With low or no VOCs emissions.
- 6- Reducing waste in all life cycle stages.
- 7- Shall be manufactured locally or nearby to reduce transportation.
- 8- Low or no environmental impact during all life cycle stages.
- 9- Enhance health and wellbeing of users.
- 10- Affordable.

This study focuses on EFIMs and their availability in the local market to better understand the situation and build on new recommendations and outcomes. As selecting EFIMs is considered as main concept to reduce IAP as controlling the source of emitting and replace it with environmental options (González-Martín, Kraakman, Pérez, Lebrero, & Muñoz, 2021; Omar & Alsarrag, 2019).

The ESID aims to create healthy indoor air environments by minimizing the buildup of indoor air pollutants. This is achieved through the use of ornamental indoor potted plants to purify the air and enhance the well-being of occupants. Phytoremediation using indoor potted plants is considered as an eco-friendly, efficient, cost-effective, and energy-free approach, which has been widely explored in scientific papers for its ability to purify various air contaminants such as VOCs. Formaldehyde (H_2CO) is a major VOCs emitted indoor from interior materials at room temperature deteriorating users' health and well-being (González-Martín et al., 2021; Khalifa, Khan, & Akhtar, 2023). Formaldehyde is selected as the gas pollutant to test the selected non-native plants efficiency in remediation it. WHO (2010) set a limit for acceptable concentrations of formaldehyde in exterior air $0.02\text{mg}/\text{m}^3$ and in different interior environments such as homes $< 0.05\text{ mg}/\text{m}^3$, schools $< 0.05\text{ mg}/\text{m}^3$, and public buildings $< 0.025\text{ mg}/\text{m}^3$ (**Figure 1.1**). However, in new buildings or renovated interior spaces may exceed these limits, leading to sensory irritation, cough, and headache when short time exposure and potential cancer with long term exposure.

Mitigating this issue requires reducing formaldehyde concentration indoors using methods like mechanical ventilation, filtration, isolation, adsorption, and oxidation (Kelly & Fussell, 2019; Khalifa et al., 2023; Teiri, Pourzamani, & Hajizadeh, 2018a; Teiri, Pourzamzani, & Hajizadeh, 2018b; Yang, Su, & Zhao, 2020). However, these traditional methods can be energy intensive and costly for the general public. Therefore, this study focuses on experimenting with a more eco-friendly and affordable method: phytoremediation using indoor potted plants. This passive approach tests the efficiency of selected non-native indoor plants in purifying indoor formaldehyde within a controlled laboratory environment.

Outdoor air	General: <0.01 mg/m ³	Industrial and highly urbanized areas: 0.02 mg/m ³
Indoor air	General: 0.01 – 0.1 mg/m ³	Homes General <0.05 mg/m ³ Range: 0.005-0.25 mg/m ³
		Schools/Kindergartens General <0.05 mg/m ³ Range: 0.002-0.05 mg/m ³
		Public buildings General <0.025 mg/m ³ Range: 0.005-0.15 mg/m ³

Figure 1. 1 Outdoor and indoor Formaldehyde exposure limits. Redrawn from (WHO, 2010 and Peng et al., 2022).

1.2 Research problem

Building materials and interior furnishings are considered the main sources of IAP, deteriorating the IAQ. This is due to the extensive development in the industrial sector, which employs chemical materials and synthetics in the production process to mass-produce new, yet technologically complex and affordable materials to fulfill the global needs (Kelly & Fussell, 2019). With the global population expected to rise to approximately 8.5 billion by 2030, and 9.7 billion by 2050, and 10.4 billion by 2100 (UN, 2022), this material may release hazardous indoor air contaminants such as VOCs. These substances evaporate at room temperature impacting the health and well-being of occupants. Moreover, modern buildings often adopt airtight buildings to reduce energy consumption, which can inadvertently impair indoor ventilation. This leads to the accumulation of indoor air pollutants, causing sick building syndrome (SBS) with symptoms such as irritation in eyes, nose, or throat, coughing, headaches, fatigue, and struggle to concentrate.

Before the COVID-19 pandemic, people spent more than 85% of their time indoors. However, during the pandemic, legal restrictions compelled people to stay indoors 100% of the time, surrounded by multiple interior elements and finishing materials in enclosed, polluted spaces.

According to WHO (2010), indoor air environments are 5 to 10 times more polluted than outdoor air.

Due to the ongoing architectural developments and massive building projects in Bahrain, along with governmental plans to build new cities and residential projects for citizens, there is a high demand for interior and finishing materials for multiple projects such as residential and commercial projects, and office buildings. Thus, new imported interior materials are supplied in to the local market to meet their needs and create aesthetically pleasing, functional, and comfortable interior spaces. However, many of these imported materials are conventional, affordable options that lack eco-friendly certifications.

Absence of guidelines for imported and locally manufactured interior materials to supply eco-friendly options to the market may lead to the prevalence of conventional materials and a decrease in public willingness to purchase eco-friendly materials. Selecting EFIMs is considered a primary method of reducing indoor air pollutants through source control. Furthermore, there is a public lack of awareness about the importance of utilizing EFIMs and its role in creating healthy indoor environments, making it crucial for interior designers to educate clients about investing in their health and wellbeing.

Indoor potted plants not only enhance the aesthetic and sensory quality of indoor spaces as decorative elements but also serve as a method of air filtration. These plants have been proven effective at purifying indoor air from multiple air pollutants, specifically formaldehyde. Formaldehyde is released from sources such as engineered wood, paints, carpets, adhesives, treated fabric, etc. It is a significant indoor air pollutant and a well-known carcinogenic and genotoxic chemical. Formaldehyde is a water-soluble chemical, it can easily penetrates in to the body through respiratory and gastrointestinal systems causing symptoms such as odor sensitivity, eye, nose and throat irritation, headaches, and eczema. Prolonged exposure to this colorless gaseous chemical may lead to nasopharyngeal cancer and myeloid leukemia (González-Martín et al., 2021; WHO, 2010).

The lack of awareness about the ability of indoor potted plants to purify hazardous air pollutants, along with the importance of placing ornamental plants indoors for their purifying effects, presents a significant problem that this study aims to address.

1.3 Research questions

The following questions have been created during planning this research projects and have been answered in the preceding text.

- What is an ESID?
- What are eco-friendly interior materials?
- Are eco-friendly interior materials available in Bahrain's local market?
- What are eco labels for EFIMs?
- Can the non-native ornamental indoor potted plants purify indoor air?
- What is the efficiency of these plants in purifying formaldehyde?
- How can public awareness about the effectiveness of indoor potted plants in purifying indoor air be increased?

1.4 Research objectives

This study aims to achieve the following objectives.

1. To get insights into ESID.
2. Study eco-friendly interior materials.
3. Study the benefits of eco-friendly materials and the role of available eco-labels.
4. Initiate recommendations for interior designers, and architects encouraging the selection of EFIMs for built environments in Bahrain.
5. Investigate the phytoremediation ability of indoor potted plants in purifying HCHO from indoor environments.
6. Increase awareness about better EFIMs and the positive impact of the indoor plants through scientific publications/knowledge creation.

1.5 Research significance

Addressing ESID by mitigating IAP is a significant and contemporary topic that has attracting the attention of researchers worldwide. The main source of IAP is the use of finishing materials indoor, which are available in the local market without quantifying studies assessing their availability. This lack of market study in Bahrain and GCC countries to analyze the current availability of

EFIMs represents a knowledge gap that this study aimed to address, providing a current overview of the local market.

Additionally, the lack of established guidelines for imported interior materials that meet eco-friendly standards, such as zero emissions, is a concern. The public's limited awareness about the importance of selecting EFIMs to achieve ESID and their understanding of eco-labels contributes to the issue, as people often prioritize cost-effective conventional options.

No previous similar experimental study has been conducted in Bahrain to assess the effectiveness of indoor potted plants in cleaning indoor air. Therefore, this gap in knowledge will be filled by this study from laboratory experiments that evaluate the efficiency of selected indoor potted plants in cleaning indoor air.

1.6 The study setting

The researcher came across two significant courses namely, Indoor planting and courtyard design and Interior finishes. One of these courses creates a solid background and curious mind for further research in the field. Especially, it is not used only to decorate the indoor environments and add aesthetic values, but also to purify the indoor air from pollutants such as VOCs and formaldehyde. The second course broadens knowledge not only about aesthetic, functionality, budget, but also about the environmental issues of the selected materials used indoor to cover the three indoor surfaces: ceiling, walls, and floor. Therefore, the author decided to conduct this study by dividing it into two parts: studying the EFIMs and the use of indoor ornamental potted plants to purify indoor air. The author decided to start this study with the intent to merge the interior environment materials and indoor plants to achieve the goal of ESIDs. An air sealed glass box was designed for the fumigation experiment testing the purification efficiency of the indoor plants which was the source of attraction for my supervisor as he broadens my mind to the importance of the experiments in Bahrain. So, we designed the box according to the reported specifications from local material. Nonnative indoor plants are accessible in local market. The project was organized accordingly, reliable data was collected and analyzed.

In relation to SDGs, this study is directly related to Goals number 3 and 12. The SDG 3 is about good health and wellbeing as it is targeted via the “SDG Target 3.9 Mortality from environmental pollution: Reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination” indicator 3.9.1: related to death rate because of indoor and

outdoor air pollution (WHO, 2023). Regarding goal 12 “about ensuring sustainable consumption and production patterns, which is key to sustain the livelihoods of current and future generations” (UN, 2023). Consumers play a significant role in considering their purchases and opting for eco-friendly options whenever possible and available (UN, 2023).

1.7 Research terminology

Environmentally sustainable interior design: It is based on the sustainable design principles and strategies common to the built environment as a whole, namely providing physiologically and psychologically healthy indoor environments (Hayles, 2015).

Eco-friendly materials: The material possessing one or more of the given attributes: comprised of recycled content and/or energy efficient. Additionally, they are locally manufactured or sourced nearby to minimize transportation cost. These materials are durable, affordable, and contribute to the health and well-being of occupants (Yudelsohn, 2007).

Eco-labels: environmental signs or logos “educate consumers about the environmental impact of the production, consumption, and waste management stages associated with the products or service they use” (Galarraga Gallastegui, 2002).

Indoor air pollution: Airborne contaminations within constructed spaces originated from various sources, encompassing particulate matter, biological pollutants and over 400 different compounds, both organic and inorganic. The concentration levels of these pollutants are influenced by numerous indoor and outdoor factors (González-Martín et al., 2021).

Sick building syndrome: “A set of symptoms related to chemical, particulate or biological exposure that cannot be related to a specific cause but are alleviated when the occupant leaves the place. Individuals report symptoms such as headaches, nausea, fatigue and drowsiness, irritation in eye, nose, and throat” (Nathanson, 1995).

SIDS: Small Island Developing State (Naser, 2022).

Phytoremediation: “Phytoremediation is a well-known technique to mitigate various organic and inorganic pollutants by plant species” (Khalifa et al., 2023).

Calvin cycle: The Calvin cycle is the primary pathway for carbon fixation and this cycle has 13 reaction steps catalyzed by 11 enzymes in the chloroplast of C3 plants (Tamoi, Nagaoka, Yabuta, & Shigeoka, 2005).

Chapter 2 Literature review

The Kingdom of Bahrain symbolizes a distinct case of a Small Island Developing State (SIDS), an archipelago located in the Arabian Gulf, like other countries of the world, experiencing various environmental challenges raised by natural and anthropogenic pressures (Bahrain.VNR, 2018; Naser, 2022; Shamna et al., 2023) (**Figure 2.1**). The total area of Bahrain is 786.5 km², the total population currently reaches approximately 1.7 million and projected to reach about 2 million in 2032; the country represents a high population density in the world (IEGA, 2021).



Figure 2. 1 Map of Kingdom of Bahrain.

Due to dry hot climate as arid to hyper arid (Radhi & Sharples, 2008; SCE, 2009), citizens of Bahrain spend more than 85% of their time inside the built environments. However, these enclosed spaces may have inappropriate installations of interior finishing materials and ventilation systems causing accumulation of indoor air pollutants posing negative impacts on human health and their comfort (Al Qassimi & Jung, 2022; Awad & Jung, 2021; González-Martín et al., 2021; Ravindra & Mor, 2022; Yue et al., 2021). In literature, two studies being focused on the air pollution in the Gulf Cooperation Council (GCC) countries, mentioned that the IAP is considered as a single human health hazard, due to the unfavorable atmospheric settings, such as raised air

temperature, relative humidity, and the existence of some natural events such as dust storms (Amoatey, Omidvarborna, Baawain, & Al-Mamun, 2018; Yeatts et al., 2012). The outdoor air pollutants originate from vehicle emissions and factories get infiltrated inside the building via doors, windows, ventilation intakes, and imperfect building envelopes (Arar, Jung, & Qassimi, 2022; Bandehali, Miri, Onyeaka, & Kumar, 2021; Ravindra & Mor, 2022; Yeatts et al., 2012). In addition, the indoor sources such as building interior materials, decorations, various finishes, offices' electronic appliances and wooden based furniture are also potential emission sources (Figure 2.2).

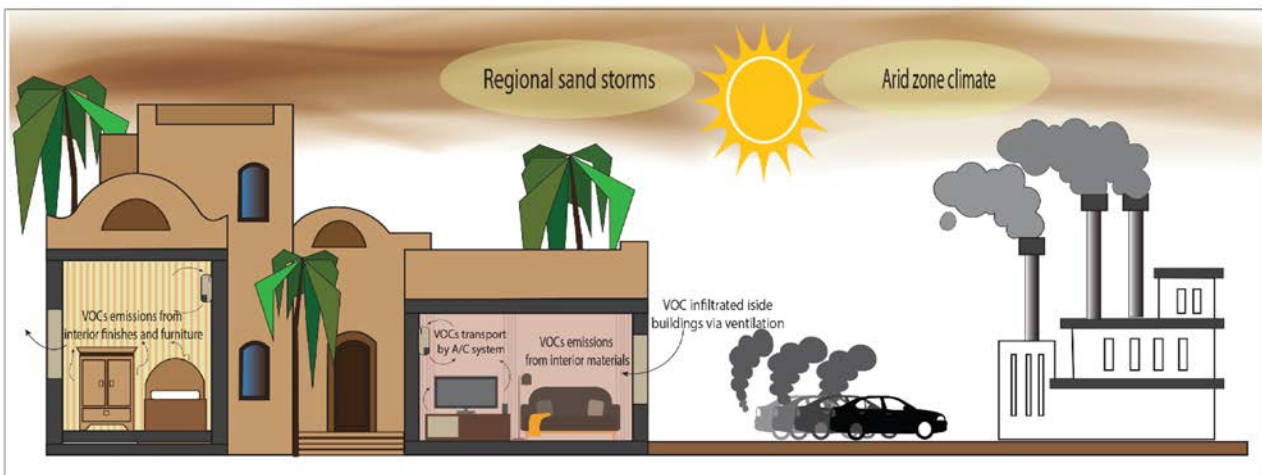


Figure 2. 2 Sources of indoor air pollution in the Kingdom of Bahrain.

In recent years, the purification of atmospheric pollution becomes the focal point of scientific research. Humanity is surrounded by nearly 200 distinct airborne pollutants, which can seriously damage the respiratory and cardiovascular systems (Han et al., 2022). The presence of many of these pollutants is responsible for emergency visits or hospital admissions and eventually causes mortality (Han et al., 2022; Orellano, Reynoso, Quaranta, Bardach, & Ciapponi, 2020). The global consideration is that air pollution (both outdoor and indoor) is a major environmental health risk resulting in about one in every nine annual deaths (WHO, 2016). As people tend to spend more than 80% of their time indoors, and as the indoor air pollutants are often 2–4 times higher than outdoor, dwellers are seriously exposed to indoor air pollutants affecting their health, well-being, and productivity levels in working spaces (M. Mannan & Al-Ghamdi, 2021a; Teiri, Hajizadeh, & Azhdarpoor, 2022; Wi et al., 2020).

The IAP may directly effects occupants' health as breathing it account for 57% of the total air breath intake of humanity (Khalifa et al., 2023; D. I. Kim et al., 2011) as indoor air may mostly be 5–10 times more polluted than outdoor air (D'Amico, Bergonzoni, Pini, & Currà, 2020; WHO, 2010). It may cause SBS which deteriorate occupants' well-being causing health complications like asthma, nausea, headaches, allergies, and irritation (Arar et al., 2022; Bell, Greene, Fisher, & Baum, 2001; Jung, Al Qassimi, Arar, & Awad, 2021a; Jung, Awad, & Al Qassimi, 2021b; Khalifa et al., 2023; Leung, 2015; Li et al., 2023; M. Wang, Li, Hou, Guo, & Fu, 2022). While long time exposure to IAP may cause non-communicable diseases, chronic obstructive pulmonary disease (COPD) and lung cancer (Jung et al., 2021a; Lee, Jun, & Zahra, 2021; Nielsen, Larsen, & Wolkoff, 2013, 2017; Ravindra & Mor, 2022; Rosário Filho et al., 2021; Sherzad & Jung, 2022; WHO, 2010; Yue et al., 2021).

Among these pollutants, HCHO is one of the most notorious pollutants present in the atmosphere. It is a volatile organic compound; toxic and chemically sensitive gas emitted from diverse indoor sources, such as wood-based construction materials, flooring, furniture, decoration elements, and other adhesives and resins (Han et al., 2022; Huang et al., 2022; L. Wang et al., 2020; Z.-F. Zhang et al., 2020), causing eyes and nose irritation and bodily discomfort. While long-term exposure may cause nervous system disorders and other carcinogenic effects (Han et al., 2022; Lee et al., 2021; Wi et al., 2020; Zhu et al., 2019). On the other hand, formaldehyde is an economically essential chemical, manufactured as an aqueous solution known as formalin (which contains 37% of dissolved formaldehyde). It is widely used as a preserving agent or as an antiseptic in medical laboratories (Salthammer, Mentese, & Marutzky, 2010). It is also mixed with other compounds to make casein formaldehyde, phenolic resins, urea formaldehyde, and melamine formaldehyde; which are used in the production of daily life products for domestic and industrial uses, such as resins, plastics, cups, saucers, lampshades, varnishes, laminates, adhesives; knitting needles, buttons, buckles, electrical automobile insulators, and other heavy industrial products. It is also widely used in glass and rock wool insulation, molding compounds, decorative laminate, and textile treatments (L. Zhang, Steinmaus, Eastmond, Xin, & Smith, 2009). Indoor HCHO is emitted from household elements including carpeting, plywood, particleboard, wooden furniture, and items from the above-mentioned industries (L. Zhang et al., 2009). Based on serious health concerns, the safe concentration of this chemical is supposed to be maintained particularly in places expected to have high concentration. The permissible exposure limit (PEL) approved by

Occupational Safety and Health Administration (OSHA) is 0.75 ppm (8 h Time-Weight Average, TWA) and 2 ppm (15 min, Short term Exposure Limit, STEL). The ACGH has set the Threshold Limit Value (TLV) to 0.3 ppm and the National Institute of Occupational Safety and Health (NIOSH) has approved 0.016 ppm (8 h, TWA) and 0.1 ppm (15 min, STEL) (L. Zhang et al., 2009). Realizing the toxicity of formaldehyde, exposure limits have been established for HCHO by various organizations worldwide. WHO and Dubai Municipality have established 0.1 ppm HCHO exposure limit for 30 min and 8 h, respectively. While the OSHA and NOISH established 0.75 and 0.016 ppm during 8 and 10 h, respectively (**Table 2.1**).

Table 2. 1 Formaldehyde acceptable exposure limits by various organizations globally.

Organization	Acceptable limit (ppm)	Timeframe	Ref.
WHO	0.1	30 min	(Nielsen et al., 2017; Teiri, Hajizadeh, Samaei, Pourzamani, & Mohammadi, 2020; WHO, 2010)
NIOSH	0.016	10 h	(NJ.Health, 2016)
OSHA	0.75	8 h	(OSHA, 2011; Teiri et al., 2020)
Dubai Municipality	0.08	8 h	(Al Qassimi & Jung, 2022; Awad & Jung, 2021; DEWA, 2020)

Many recent studies have reported several methods in minimizing IAP and indoor air formaldehyde contamination, such as through ventilation (it is effective but costly and energy consuming), the use of air purifiers' portable devices (less effective and costly), and the utilization of air-cleaning indoor ornamental plants (phytoremediation, cheap, effective, and enhance the esthetic value of the indoor environment (Al Qassimi & Jung, 2022; Khalifa et al., 2023; Li et al., 2023; Pamonpol, Areerob, & Prueksakorn, 2020; L. Wang et al., 2020). While, another method is considered the optimum method and is known as the source prevention of indoor pollutants emission by utilizing ecofriendly interior materials (EFIMs) (Al Qassimi & Jung, 2022; González-

Martín et al., 2021; Hayles, 2015; Jung, Alqassimi, & El Samanoudy, 2022a). It has minimal negative impacts on the environment and inhabitants because it is made of natural, renewable, or recycled materials and have low toxicity and low or no chemical emissions providing positive impacts during its life cycle (Cheng, Lin, & Hsu, 2015; Hayles, 2015; Jung, Alqassimi, & El Samanoudy, 2022c; Yudelson, 2007). Thus, mitigating IAP and achieving a healthy built environment and minimizing indoor air pollution are important goals of interior designer practices.

Hayles (2015) agrees with Kang and Guerin (2009) in differentiating between traditional and recent interior design, with the latter being more environmentally friendly, and sustainable. While traditional interior design is one-dimensional practice toward enhancing the aesthetic values of indoor spaces and meeting the functional needs to satisfy the clients desires. Moreover, traditional interior design was described as relatively backward focusing only on luxury and beauty inside limited spaces. While ignoring other important issues such as the energy conservation, pollutants emission reduction, adverse impacts on consumers; health and well-being and last is the environmental pollution prevention (Hayles, 2015; Kang & Guerin, 2009b). Interior design sector is currently shifted significantly to more than one-dimensional practice concentrating on creating healthy and sustainable built environments that minimize the negative impacts on the occupants and environment and maximizes the positive impacts on economic, social, and environment over the life span of the indoor spaces (Abdelslam, 2017; Rashdan & Ashour, 2017). This new direction has attracted the global interest and glowed the idea of environmentally sustainable interior design (ESID). Rashdan & Ashour (2017) stated that ESID creates functional, healthy, comfortable, and sustainable spaces without minimizing the aesthetic values, while meeting the clients; desires, budget, time and design solutions (Rashdan & Ashour, 2017). ESID aim is creating indoor spaces that are physiologically and psychologically healthy (Hayles, 2015). It combine the meaning of two terms; environmentally which refers to peoples' health, safety and planet resources (Abdelslam, 2017). While sustainability encounter a more abroad targets such as health, safety, well-being of the planet for meeting the needs of this generation without affecting the ability of the coming generations to meet their needs (Ćurčić, Jovanovic, Kekovic, & Randelović, 2019; Hayles, 2015; Rashdan & Ashour, 2017). Another definition is meeting the demands of the present without effecting the ability of the coming generations in meeting their own demands by improving the indoor air quality and the use of eco-friendly materials (Altin, 2016; Kang & Guerin, 2009a,

2009b). While Alfuraty (2020) defined the built environment as human-made for humanity settling, working, entertaining enclosed from outdoor conditions (Alfuraty, 2020).

Interior designers, decorators, and architects are all responsible of implementing ESID concept in all their projects, whether it is new building projects or renovation of available built environment (Hayles, 2015). Moreover, interior designers share a big responsibility in applying ESID solutions in all their design stages and prevent hazardous emissions, prevent harmful chemical substances presence to prevent IAP (Rashdan & Ashour, 2017). Another researchers elaborated ESID that it is a professional practice that aim to create indoor spaces that are sustainable and healthy for its occupants (Ćurčić et al., 2019).

In the current thesis study, in order to achieve ESID by mitigation of indoor air pollution, two directions are investigated and deeply studied which are the use of eco-friendly interior material (EFIMs), and the phytoremediation of indoor air pollution by indoor potted plants (experiment study).

2.1 Eco friendly interior materials (EFIMs)

The environmentally sustainable indoor space (ESID) required the application of eco-friendly interior materials (EFIMs). Researchers confirmed that as the global population has a steady growth and the vast development of industries and technologies, the demand for building materials and interior materials have been increased the most consequently creating many environmental issues such as pollution, toxic emissions and the depletion of natural sources and many indoors problems such as IAP, SBS and decrease IAQ levels. Which initiate a strong demand for the production and supply of EFIMs globally (**Figure 2.3**) (Alfuraty, 2020; Bakhoun, Garas, & Allam, 2015; Ćurčić et al., 2019; Wi et al., 2020).

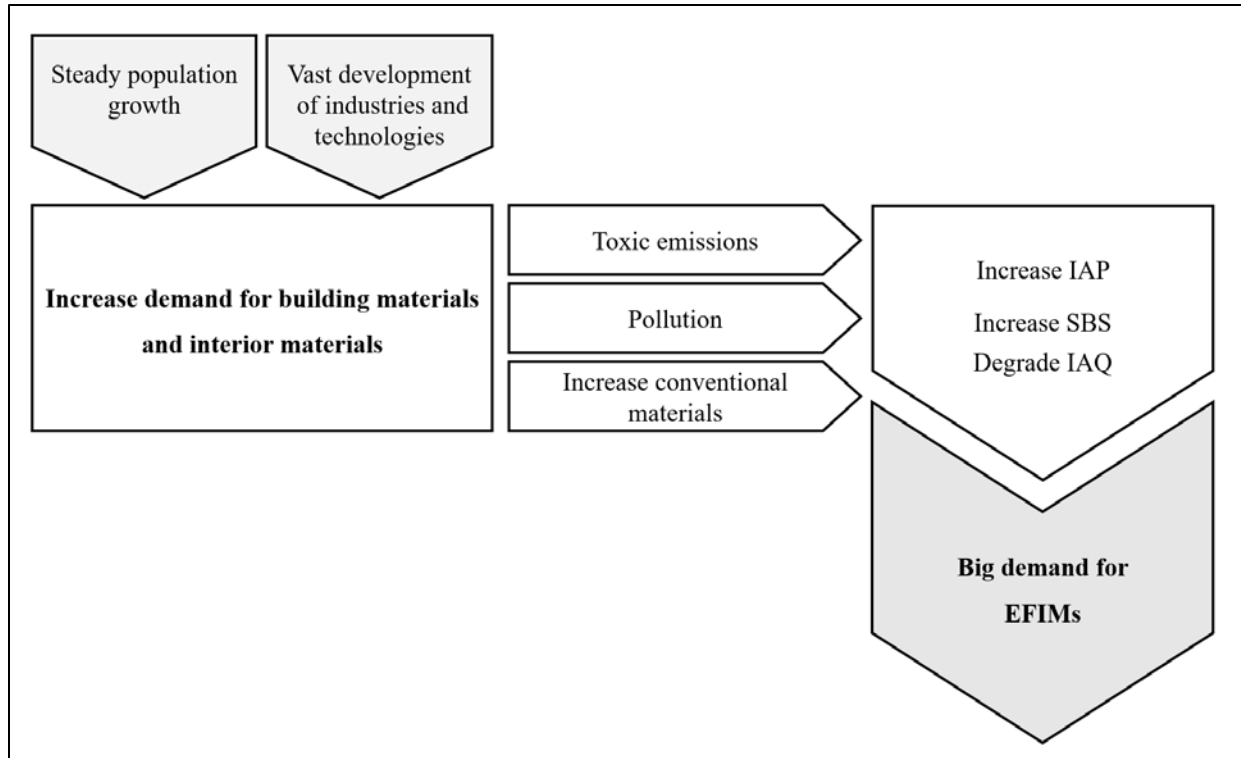


Figure 2. 3 A flowchart indicating the demand for EFIMs.

Salci (2019) agreed with Koca (2016) in defining the interior finishing materials as the last layer that installed to protect the three interior surfaces: ceiling, walls, and floors and they are placed to provide a form and boundaries of the built environment. It has a strong role not only on the visual aspects, but also on the psychological meanings (Koca, 2016; Salci, 2019). Moreover, the spatial quality is mainly determined by these interior materials (Altay & Salci, 2023). EFIMs are defined as materials that have no or less negatives on human health and ecosystem and are not necessarily being fully sustainable yet are considered better option (Alfuraty, 2020; Binggeli, 2014; Wi et al., 2020). While others, D' Amico et al. (2020) stated than the use of eco-friendly materials as well as using better design solutions and mitigating any pollutant exposure indoor are important steps to achieve healthy built environment (D'Amico et al., 2020). Along similar lines, Kang and Guerin (2009) confirmed that specifying EFIMs help reduce air pollution in the indoor environments while minimizing input of raw materials and output of waste materials (Kang & Guerin, 2009a).

Hayles (2015) stated that selecting eco-friendly interior materials (EFIMs) is increasing globally as specifying and purchasing due to clients are starting to realize their role and impact on the environment and the enhanced awareness toward diminishing of natural resources and the spreading need for healthier, green, energy efficient built environments (Hayles, 2015). Moreover the establishment of the green building systems which assess the building sustainability and provide a degree on the level of the building being green or sustainable. There are various systems globally who certificate the whole building (not only the built environments) according specific criteria and then gain points/ credits (Ćurčić et al., 2019; Hayles, 2015; Yudelso, 2007). Examples of the most used green building rating systems are Leadership in Energy and Environmental Design (LEED), Building research Establishment Environmental Assessment Methods (BREEAM), Comprehensive Assessment System for Built Environment Efficiency (CASBEE), and Al Sa'fat Dubai Green Building System summarized in Table 2 (Altin, 2016; Winchip, 2007). One of the first rating systems for green building is BREEAM; which was implemented in 1990 in UK depending on several criteria such as: management, health, energy, transport, water, materials, waste, land use, ecology, and pollution. After this, LEED was created as a green building system in USA in 1998 focusing on this criterion: sustainable site, water efficiency, energy efficiency, material and resources, indoor environmental quality, innovation in design, and regional priority. While in Japan 2004, CASABEE was initiated focusing on these criteria: energy efficiency, resource efficiency, local environment, and indoor environment. Recently, the Dubai Municipality initiated Al Sa'fat Dubai Green Building System in 2016, focusing on these criteria: ecology and planning, building vitality, energy efficiency, and resource effectiveness: water, materials, and waste (**Table 2.2**).

The selection of EFIMs is considered as the most cost-effective, and environmentally preferable method to mitigate the problem of IAP and the problem of off gassing phenomena from interior finishes and wooden furniture (Ćurčić et al., 2019). In contrast, conventional interior materials are globally manufactured products from easily accessed, low cost raw materials while not prioritizing the environment or the users' health and safety and being not certified by any environmental organizations (Alfuraty, 2020; Bakhoun et al., 2015; Cheng et al., 2015).

Table 2. 2 Green Building Rating systems with its criteria.

Name	Long name	Country	Year of implementation	Criteria
BREEAM	Building research Establishment Environmental Assessment Methods	UK	1990	- Management - Health - Energy - Transport - Water - Materials - Waste - Land use and ecology - pollution
LEED	Leadership in Energy and Environmental Design	USA	1998	- Sustainable site - Water efficiency - Energy efficiency - Material and resources - Indoor environmental quality - Innovation in design - Regional priority
CASBEE	Comprehensive Assessment System for Built Environment Efficiency	Japan	2004	- Energy efficiency - Resource efficiency - Local environment - Indoor environment
Al Sa'fat	Al Sa'fat – Dubai Green Building System	Dubai	2016	- Ecology and planning - Building vitality - Energy efficiency - Resource effectiveness: water, materials, and waste (Dubai-Municipality, 2020).

The EFIMs mainly follow natural production system that have no negative impacts during its life stages. Examples of EFIMs and conventional interior materials are presented in **Table 2.3** as for ceiling interior surface, the example for conventional interior material could be wood panels from non-certified sources, while the EFIM example could be acoustical gypsum ceiling panels or tiles. For the walls interior surface, the example for conventional interior material could be gloss wall paints, while the EFIM example could be water-based wall paint. For the floor interior surface, the example for conventional interior material could be artificial fibers carpet fixed with the help of ordinary glue, while the EFIM example could be natural fibers carpet with glue associated with low VOCs.

Table 2. 3 Examples of Eco-friendly and conventional interior materials.

Interior surface	Interior finishing materials	
	Conventional	Eco-friendly
Ceiling	Wood panels from non-certified sources	Acoustical gypsum ceiling panels or tiles
Walls	Gloss wall paints	Water based wall paint
Floors	Artificial fibers carpet fixed with ordinary glue	Natural fibers carpet with low VOCs glue

The material selection is a crucial step that built the functionality and aesthetic systems for interior spaces (Bettaieb, Malek, & Alawad, 2019). The properties of these materials may vary according to the origin and are categorized into: natural materials such as stone, processed materials that result from processing natural materials such as ceramic tiles, and synthetic materials that result from manufacturing processes using artificial materials such as vinyl and other polymeric material (Alfuraty, 2020; Bettaieb et al., 2019).

Interior materials are further classified into 6 families which are natural, metals, plastics, tiles, composites, and others (Binggeli, 2014; Koca, 2016; Riggs, 2013; Salci, 2019) (summarized in **Table 2.4**).

Table 2. 4 Interior materials families, their properties, and usage indoors.

Materials families	Types	Interior surfaces			Properties
		Ceiling	Walls	Floors	
Natural materials	Wood	×	×	×	Durability, easy to transform and cut, organic in nature, may deteriorate due to environmental factors (chemical, physical, and biological) and may vary according to origin and species.
	Stone		×	×	
Metals	Aluminum	×	×		Durability, ductility, high strength, hardness.
	Steel		×	×	
Plastics	Vinyl (PVC)	×	×	×	Lightness, high resistance against environmental factors, low thermal conductivity, high coefficient of thermal expansion, high tensile strength.
Tiles	Ceramic		×	×	High strength with low ductility necessitates, high gross density, hardness, compressive strength, abrasion resistant.
	Porcelain		×	×	
Composites	Terrazzo		×	×	Lightness, strengths, stiffness.
	Laminated materials	×	×	×	
Others	Concrete	×	×	×	- Durable, high strengths, hardness - High gross density, compressive strengths, and hardness. - Add color, durability, decoration, add level of gloss that effect maintenance. - Durable and can hide wall imperfections, printed by machines or manually. - Acoustical properties, with additives it can be water, stain, flame resistance.
	Glass		×	×	
	Paint	×	×		
	Wall paper	×	×		
	Textile	×	×	×	

Salci (2019) elaborated 6 classes of interior materials and their properties as following:

- 1- Natural materials: include wood and stones which are both durable, hard, and may be affected by environmental factors, properties of wood depend on the nature of the tree, the location, growth rate of the tree and climate. While stone properties depend the most on the origin such as marble, granite, and slate.
- 2- Metals: are durable hard, ductile materials used inside built environments due to its structural strength and aesthetic appeals. It is used as panels or tiles for ceiling, walls, and floors.
- 3- Plastics: are easy to process and formulate globally in an affordable cost. It is light weight, with low gross density, and negligible thermal conductivity, high tensile strength and high resistance against environmental factors. Used indoor as wall panels, vinyl tiles or rolls for floors and as Poly Vinyl Chloride (PVC) stretched fabric for ceiling covering.
- 4- Tiles: are made of firing clay which become waterproof, dense, hard, strong, and resistant to abrasion that make it perfect for flooring and wall covering.
- 5- Composites: are a group of materials combined to capture a novel set of properties not available in a single material. It is characterized as light, strong, and stiff material that can vary according to the design needs.
- 6- Others:
 - Concrete is hard, dense, economic, and strong material that can be mold into any shape and installed in many forms. It can be exposed on ceiling, walls, and floors to give the industrial style indoor.
 - Glass is dense, strong, and hard material used indoor as glass blocks wall, glazed partitions, floor tiles and mosaic.
 - Paint is the most economical interior finishing material available in any color and used mainly to cover and decorate ceiling and walls providing different levels of gloss.
 - Wallpaper is durable and can enhance visual aesthetic by the decorated front face that is printed by machines or hand-made and adhered to a backing layer. It is installed indoor to walls and sometimes to ceiling.
 - Textile are made from natural and man-made materials that can be applied on walls, floor, or ceiling of built environment such as rugs and natural fiber woven mats.

While other authors, specify some general criteria for selecting materials for interior design projects, Bettaieb et al. (2019):

- 1- Functional criteria: is related to durability, ease of use, safety, and acoustical aspects, ease of maintenance, repair, and cleaning.
- 2- Aesthetic criteria: is related to color, patterns, and texture.
- 3- Economic criteria: is related to the total cost of initial, ongoing, and estimated cost for maintenance, repairing and cleaning.
- 4- Environmental criteria: is related to the environmental impacts of extracting and manufacturing materials and whether it is renewable, recyclable, and toxic free materials.

Thus, interior designers are selecting interior materials according to the needs, aesthetics, budget, and clients' preferences (Bettaieb et al., 2019) with deep concern about the environmental impacts of their selection during its entire lifespan. Abdelslam (2017) defined life cycle assessment (LCA) as evaluation from cradle-to-grave of a material starting from raw material extraction, to processing, transportation, using, and disposal or recycling (Abdelslam, 2017). The life cycle of the selected material is divided into three phases namely pre-building, building, and post building and in all these stages the environmental impacts must be monitored and minimized (**Figure 2.4**) (Ćurčić et al., 2019; Hussein, 2012; Rashdan & Ashour, 2017; Yudelso, 2007).

Studying the availability of eco-friendly interior materials in the local market is considered a complex and time-consuming task due to the enormous range of available finishing materials (Altay & Salcı, 2023; Hayles, 2015; Salcı, 2019). There are limited studies which focus on studying the eco-friendly interior materials in local projects (Alfuraty, 2020; Hussein, 2012). However, Hayles (2015) studied the availability of EFIMs and its properties in the UK market (Hayles, 2015).

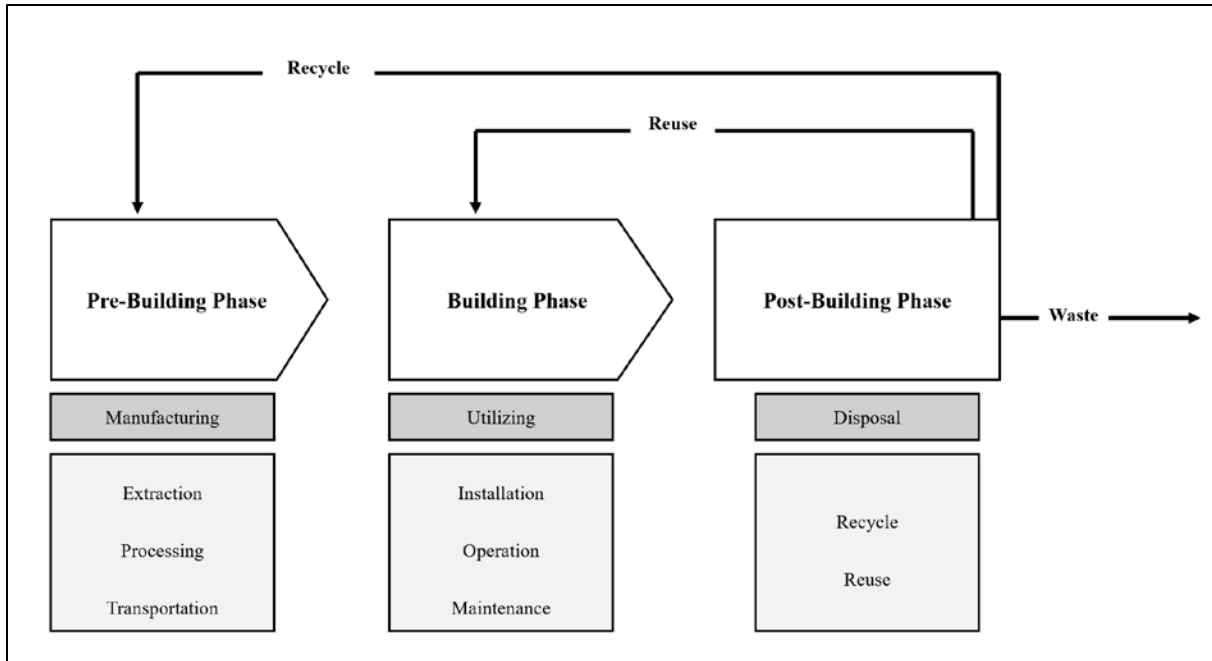


Figure 2. 4 The life cycle phases of building finishing materials.

The EFIMs are promoted as green, environmentally/eco-friendly, eco-efficient or certified materials with eco-labels which communicate that this material has met specific environmental criteria (Alfuraty, 2020; Galarraga Gallastegui, 2002; Rashdan & Ashour, 2017). Eco-labels are controlled by either government agencies, private sectors, or nonprofit environmental organizations. These third-party certification bodies are working to implement and advocate environmentally sustainable precautionary criteria. It is classified into single attribute certification focusing only on one performance area such as VOC emissions like GREENGUARD, and into multi attribute criteria assessing the full life cycle of the product of all environmental issues such as Blue Angel (Binggeli, 2014; Galarraga Gallastegui, 2002; Rashdan & Ashour, 2017; USEPA, 2022; Yokessa & Marette, 2019) (**Figure 2.5**). Rashdan & Ashour (2017) and Galarraga Gallastegui (2002) added that the third-party certification is widely applied as materials, being tested by independent, reputable, and unbiased third-party to meet specific criteria. Then it is awarded the certification or the eco-logo to be used for a specific period of time after completing the required forms and paying the mandatory fees (Galarraga Gallastegui, 2002; Rashdan & Ashour, 2017). Eco-labeling aims to educate consumers about the negative environmental impacts

of the products, its consumption, and disposal phase of the selected items. Moreover, it aims to encourage manufacturers and suppliers to maximize the environmental standards of their products (Binggeli, 2014; Galarraga Gallastegui, 2002; Rashdan & Ashour, 2017; USEPA, 2022; Yokessa & Marete, 2019).

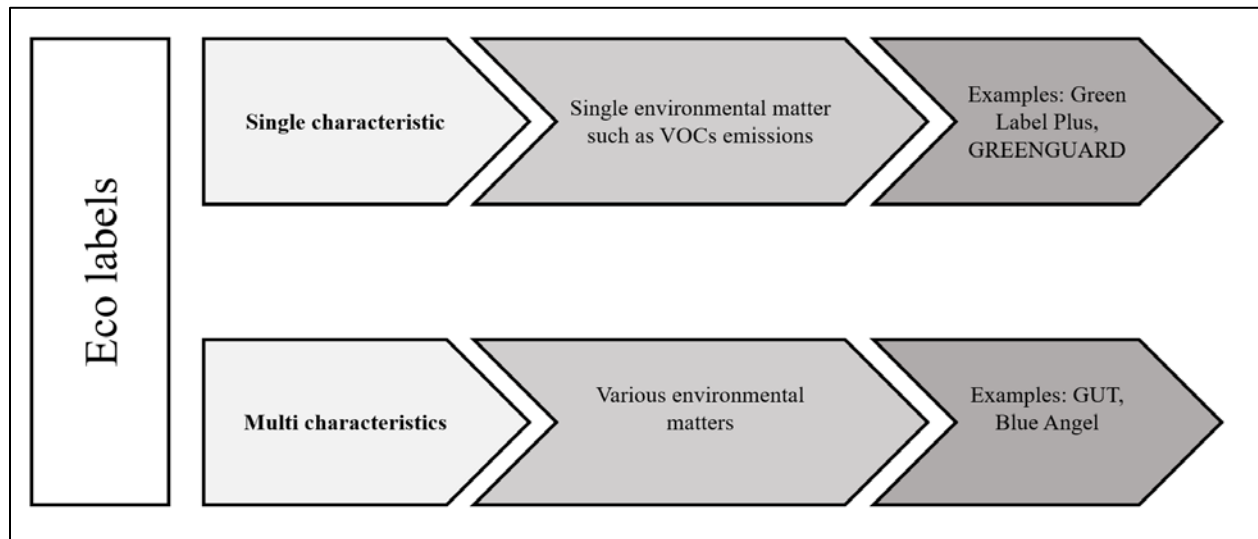


Figure 2. 5 Eco-labels classification with examples.

Some authors like Galarraga Gallastegui (2002) have given five benefits of eco-labels, mentioned below:

1. Save consumers' time while searching for EFIMs.
2. Enhance the sales of the company.
3. Encourage manufacturers to account for their production's environmental impact.
4. Enhance awareness of consumers about the environmental problems of their selection.
5. Help protecting the eco-system.

Added to this, the main aim of the eco-labeling programs is to encourage a positive move toward more environmentally friendly consumption habits in all sectors including interior design and construction (Galarraga Gallastegui, 2002).

Even though Bahrain market is relatively diverse and small, a lot of interior materials suppliers and interior designer offices are available to assist interior designers, interior architects, decorators, and clients in their material selection of their interior design projects. However, there have been

no market survey of the availability of EFIMs in Bahrain and in the Arab region only one study done by Hayles (2015) pertaining to the UK market (Hayles, 2015).

To fill a gap in the literature, this study investigates the availability of EFIMs and related eco-labels in Bahrain's local market supported by retailers' interviews to have full vision about the current availability of EFIMs.

As for as our awareness is concerned, this study represents the first exploration of EFIMs availability in local market for interior surfaces, both locally within the Arab region and globally.

2.2 Phytoremediation by indoor plants to mitigate IAP.

Phytoremediation is a feasible, cost effective, eco-friendly method. Which provides continuous purification performance during day and night (Deng & Deng, 2018; Khalifa et al., 2023; Kumar, Verma, Thakur, Singh, & Bhargava, 2023; Lee et al., 2021; Nedjimi, 2021; Teiri et al., 2020; Thomas, Kim, & Kays, 2015). It is effective, eco-friendly, and sustainable method to improve IAQ and decrease air pollution and heavy metal concentration in soil segments (Khalifa et al., 2023). It is a novel technique to capture, adsorb, assimilate, stabilize, transfer or eliminate air pollutants using plants through stomata and microorganisms (via direct adsorption to the plant surface) which degrade or detoxify them (Bandehali et al., 2021; Ravindra & Mor, 2022; Raza et al., 2021).

Absorption and degradation of atmospheric pollutants are main processes during phytoremediation which depends on the metabolic activities of plants (Han et al., 2022; Lee et al., 2021). Indoor plants are mainly herbs and/or small shrubs and the adsorption ability of pollutants can be measured via airtight experimental containers. On the other hand, outdoor plants are mainly trees or big shrubs and their purification impact can be directly evaluated by the adsorption ability of their foliar surfaces and roots (Han et al., 2022).

Remediation efficiency of plants depends on certain factors such as rhizosphere, temperature, humidity, season and type of the plant (Peng et al., 2022). Light plays a critical role in the life cycle of plants, effectively influencing their growth, indoor ornamental plants, in comparison to outdoor plants, receives this crucial parameter at limited levels (Rehman et al., 2017; Shagol et al., 2018; Weerasinghe et al., 2023). As it is frequently located in less-than optimum places within

interior spaces to satisfy both functional and spatial aesthetic values, it often leads to insufficient light intensity required for their growth (Jung & Arar, 2023). Generally, plants are classified with response to light intensity requirements into: low, medium, high, and very high light plants; Indoor plants fall in low to medium light intensity category (Rehman et al., 2017; Shagol et al., 2018). Shade plants and tropical houseplants are the most types employed as indoor plants that can prosper in low light situations (Jung & Arar, 2023). Plants situated in indoor environments require similar environmental growth factors that offer in their natural home environment. For example, effective artificial light must be provided indoor with balanced intensity, quality, and photoperiod (Egea, Pérez-Urrestarazu, González-Pérez, Franco-Salas, & Fernández-Cañero, 2014; Zielinska-Dabkowska, Hartmann, & Sigillo, 2019).

- **Light intensity** represent the amount of light and it's measured by two methods. First, Lux which is globally used for measuring and comparing the brightness of visible light (REF). Second, photosynthesis photon flux density (PPFD) which refers to the amount of light reaching the plants' leaves suitable for active photosynthesis and it measures all the photons within the photosynthetic active radiation (PAR); measured in micromoles per square meter per second ($\mu\text{mol}/\text{m}^2/\text{s}^1$)(Egea et al., 2014; Langhans & Tibbitts, 1997).
- **Light quality** refers to the spectral composition of the light source as plants do not equally absorb different wavelengths such as red and blue represent most wavelengths absorbed by chlorophylls and other photosynthetic pigments in plants. It covers the light spectrum 400 – 700 nm which is needed to support photosynthesis of plants (Egea et al., 2014; Zielinska-Dabkowska et al., 2019).
- **Photoperiod** known as the period for the plant to get exposed to the sun daily as light cycle. It is crucial factor for plant growth as it impact different plant growth processes such as flowering etc. (Egea et al., 2014).

Several artificial grow light sources used for indoor landscaping, such as light-emitting diodes (LED), fluorescent, incandescent, and high intensity discharge lamps (Egea et al., 2014). According to Tan et al. (2017), it is recommended to provide at least 1000 lx of illumination for indoor plantations in practical settings. This of illumination is considered equivalent to overcast sky conditions suitable for full-shade indoor plants and is equal to $18 \mu\text{mol}/\text{m}^2/\text{s}^1$ (Tan, Wong, Tan, Ismail, & Wee, 2017). In a recent paper (Franek & Jarský, 2021), it is described that light

intensity PPFD less than $10 \mu\text{mol}/\text{m}^2/\text{s}$ for indoor environments is considered as low-light level, while providing PPFD values around $50 \mu\text{mol}/\text{m}^2/\text{s}^1$ is high-light level.

Phytoremediation is divided into passive and active bio-filtration systems. The passive system is defined as a plant-soil system where the plant is grown in different pots and watered regularly as needed (potted plant PP) or vertically planted in hanging lightweight pots with growing media (green walls and vertical gardens). This system is slow in purifying low concentrations of indoor air pollutants because it relies on the diffusion of the gaseous indoor pollutants (González-Martín et al., 2021; Han et al., 2022; Mehzabeen Mannan & Al-Ghamdi, 2021b; Teiri et al., 2022). Due to the limitation of the passive phytoremediation system, recent focus is on creating an active green wall-based system (vertical hydroponic system). Which integrates the use of mechanical devices (low power fans—active fan assisted hydroponic technology) to create an airflow of the polluted indoor air forcing it to flow toward the whole plant getting intimately in contact with its aerial (leaves and stems) and rhizosphere parts (roots and microorganisms). Thus, phytoremediation will be significantly higher (Bandehali et al., 2021; González-Martín et al., 2021; Moya, van den Dobbelsteen, Ottelé, & Bluyssen, 2019; Pettit, Irga, & Torpy, 2018b; Teiri et al., 2022). Another reason for maximizing phytoremediation is the plant's high density as a large number of plants grown compared to the limited floor area being utilized (vertical alignment) with the aid of mechanical ventilation (Pettit et al., 2018b). In the active system, the air is forced through the aerial plant and rhizosphere microorganisms, while in passive system plant and microorganisms act as a sink for air pollutants that produce clean air by capturing pollutants or converting them into less toxic molecules (Soreanu, Dixon, & Darlington, 2013).

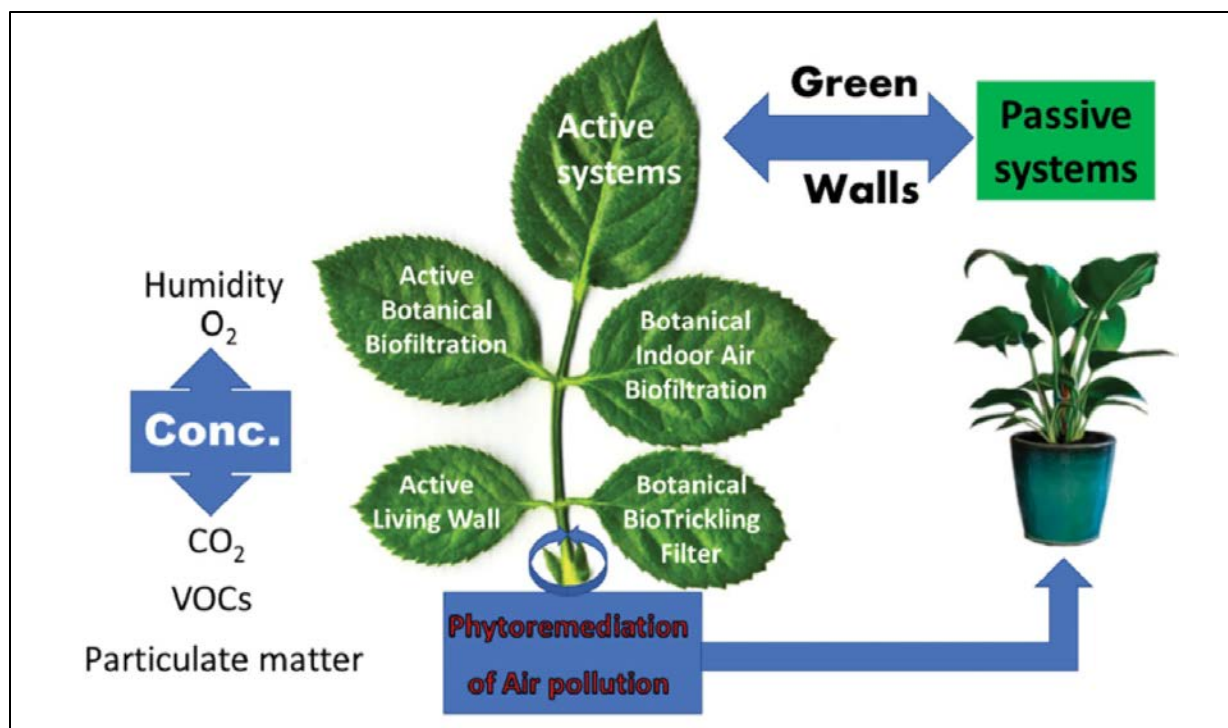


Figure 2. 6 Passive and active modes of phytoremediation of indoor air pollutants.

There are various terminologies referred to phytoremediation, such as active botanical bio-filtration (ABB), and botanical indoor air bio-filters (BIAB) (Ibrahim, Chong, & Yusoff, 2018; Pettit et al., 2018b). Furthermore, active living walls (ALW), active green walls (Mehzabeen Mannan & Al-Ghamdi, 2021c; Pettit, Irga, & Torpy, 2019; Pettit, Irga, & Torpy, 2018a; Pettit et al., 2018b), and Plant-assisted bio-trickling filters (PBTF) (Soreanu et al., 2013), are summarized in **Figure 2.6**. In the current study the passive system that is defined as a plant-soil system is investigated in detail.

2.2.1 Potted plants (PP)

The PPs has been a focus of researcher for the purification of indoor air from organic pollutants (Irga, Pettit, & Torpy, 2018). They are passive removers of pollutants from the air and have a much slower rate than other techniques/systems. They can be used for relatively less polluted air, their efficiency and decontaminating efficiency cannot be controlled. Still, PPs play

their role in controlling air pollution and some plants have been found very proficient in eliminating VOCs, such as formaldehyde (Teiri et al., 2018a; Z. Xu, L. Wang, & H. Hou, 2011), and other VOCs. They suffer from certain limitations in addition to the abovementioned, i.e., they need soil as growing media that is not least desired in some houses and their maintenance is somehow a challenge.

2.2.2 Benefits of phytoremediation

Phytoremediation is counted as one of the promising depollution technologies with the benefit of high efficiency, cost effectiveness, effortless operation, and the avoidance of forming secondary pollution (Yang et al., 2020). On the other hand, elevating the ventilation rate indoors to dilute the indoor air pollutants is often complex and costly process. Thus, phytoremediation becomes a significant alternative because of its vast benefits to the environmental, social, and economic sectors with its potential contribution to zero emissions (Teiri et al., 2022). In addition, it can reduce the dependency on costly and energy-consuming mechanical ventilation and the installation of filters to purify indoor air and improve IAQ (Han et al., 2022; Teiri et al., 2018a; Teiri et al., 2018b). Green systems inside an indoor environment have many benefits that have positive effects on the space users as their satisfaction, comfort, and happiness levels increase (Moya et al., 2019). Plants reduce the temperature and act as passive acoustic insulation by reducing levels of indoor sound. Surprisingly, the active system has several other benefits, such as minimizing indoor temperature, enhancing relative humidity, and enhancing sound insulation (González-Martín et al., 2021; Moya et al., 2019). Quantitatively, a decrease in temperature by 1°C, an increase in humidity by about 9–13%, and save 20% of fresh air instead of outdoor air (Z. Wang & Zhang, 2011). An additional benefit is to reduce the indoor temperature, which reduces the energy needed for cooling the indoor environment, additionally; it adds esthetic benefits for the space users. Added to this, the environmental, economic, and social benefits of this system are worth mentioning (Ghazalli, Brack, Bai, & Said, 2018; González-Martín et al., 2021; Mehzabeen Mannan & Al-Ghamdi, 2021c). As a result, during plants' natural life cycle and growing habits, it can purify atmospheric pollutants, such as hazardous compounds (organic compounds and metals), greenhouse gases, etc. (Han et al., 2022). Additional benefits of growing plants decrease airborne pollutants, capturing air microbes, and cleaning up indoor spaces contaminated with

formaldehyde, benzene, and other volatile contaminants (Han et al., 2022). Indoor plants decrease physical tiredness, improve mental health, positively change the health status of space users specifically asthmatic patients, and reduce the level of indoor VOCs (H. H. Kim et al., 2014). Ornamental indoor plants are capable of minimizing energy consumption and can emerge in the recent trend of sustainable green buildings (Soreanu et al., 2013).

2.3 How do plants absorb formaldehyde?

It is proposed that formaldehyde is absorbed by plants through not only stomata and cuticles in leaves but also by the root system and soil microorganisms (Teiri et al., 2018a; Teiri et al., 2018b). Formaldehyde is degraded, detoxified, or sequestered by promoting plant growth (Teiri et al., 2018a). Stomata on plant leaves are responsible for the absorption of the air pollutants and purifying HCHO via conversion into non-toxic substances and discharging it either by the root system or by concentrating it inside the branches. While enzymes in the plant metabolism are responsible for the decomposition and degradation of multiple air pollutants (Han et al., 2022; Rachmadiarti, Purnomo, Azizah, & Fascavitri, 2019; L. Wang et al., 2020). Studies confirmed that the growing media not only supports the plant by holding the roots but also simplifies the primary pollutant removal process. Using different growing media resulted in different removal rates and adding activated carbon may significantly increase the purification rates of gaseous pollutants (Pettit et al., 2018a). In the plant leaves, the absorbed HCHO is converted into CO₂ (via oxidation) or other combinations inside the plant body, for example, organic acids, amino acids, sugars, and water in the Calvin cycle, **Figure 2.7** (Teiri et al., 2018b).

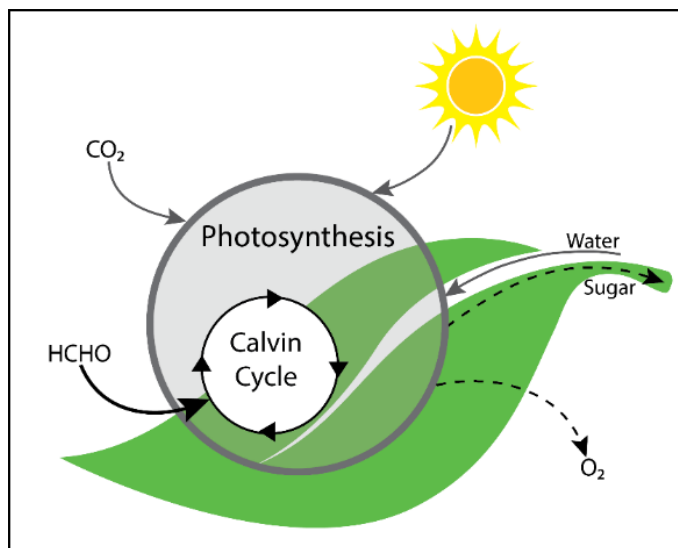


Figure 2. 7 Formaldehyde decomposition inside the plant entering the Calvin cycle and the photosynthesis process.

2.4 HCHO metabolism in plant

In an absorption experiment utilizing *Chlorophytum comosum*, ^{14}C was used to label formaldehyde, results revealed the presence of HCHO in the cell tissue of the plant. This experiment emphasizes presence of ^{14}C in the molecule of formaldehyde. The *C. comosum*'s ability in converting HCHO into organic acids, amino acids, and sugars by the metabolic reaction was explored. Thus, it is evidenced that plants can purify pollutants via self-metabolism (Schmitz, Hilgers, & Weidner, 2000). The aerial part of the plant and the root zone both compete in adsorbing HCHO while the rhizosphere plays an essential role in VOCs degradation (Bandeali et al., 2021; Lee et al., 2021). Potted plants can remove HCHO from air as it undergo dehydrogenase in plant tissues with the help of microorganisms in the roots and substrates to enhance the removal ability. Enzymes in plants are responsible for purifying HCHO from polluted air, **Figure 2.8** (S. Zhao, Su, & Liang, 2019).

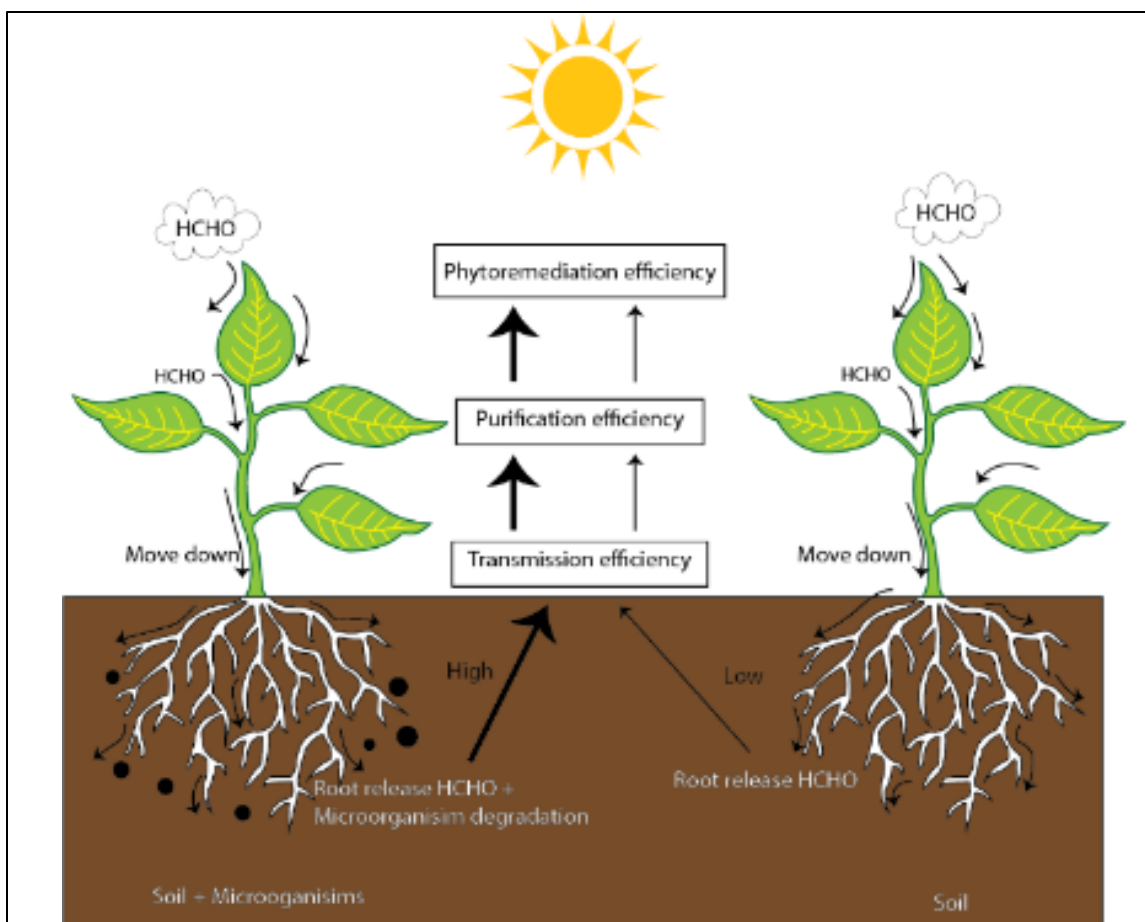


Figure 2. 8 HCHO metabolism in plants.

Inside the plant, HCHO is enzymatically transformed by particular dehydrogenases to either formic acid and eventually to CO_2 and H_2O or into amino acids, sugars, CO_2 , H_2O , and biomass (Peng et al., 2022; Soreanu et al., 2013) (**Figure 2.9**).

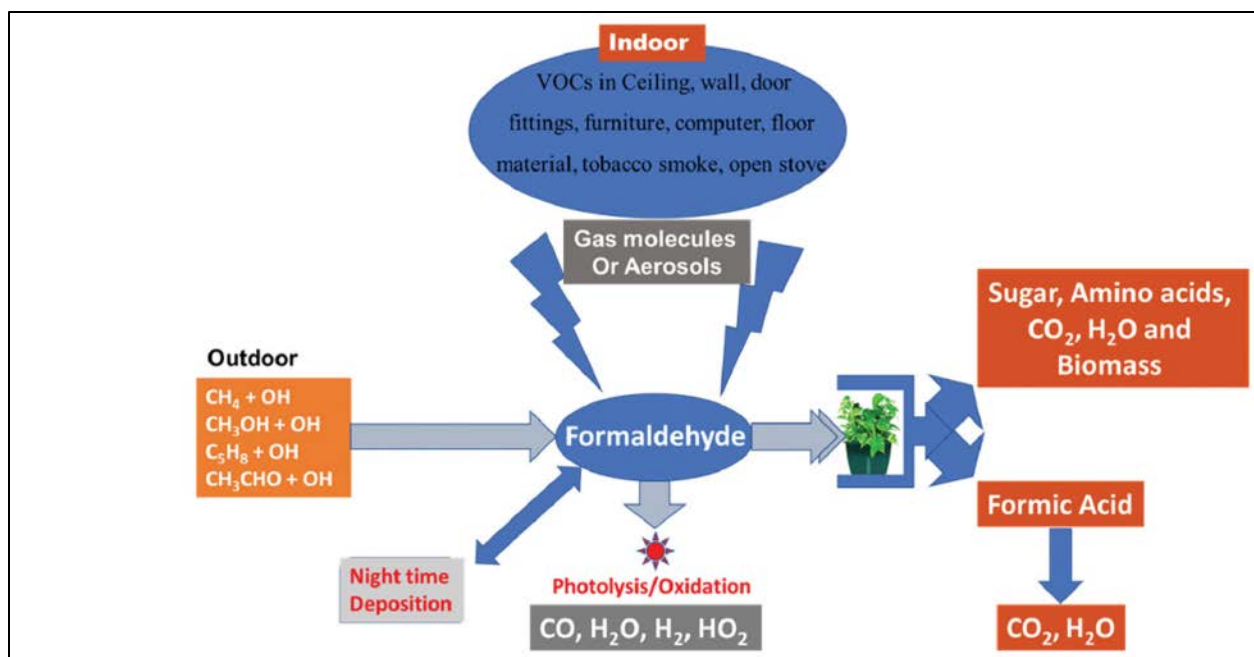


Figure 2. 9 Common in-/outdoor sources of HCHO remediation/decomposition.

2.5 Damage to indoor plants by HCHO

Plants can survive breathing ambient air polluted with enough HCHO. Nevertheless, when exposed to enormous amounts of HCHO for a lengthy period, it will be negatively impacted by turning in to yellow, getting flaccid and loosen, growing slowly, and eventually dying (Su, Liang, Zhao, & Liu, 2019). Two HCHO fumigation studies show that exposing *N. obliterate* potted plant up to 11 mg/m^3 , and exposing *C. elegans*, another potted plant up to 16 mg/m^3 could not stop the growing nature of the plant due to the high resistance of the plant and high tolerance toward HCHO (Teiri et al., 2018a; Teiri et al., 2018b). In another study Zhou et al (2011), exposed 30 indoor potted plants from three distinct species to air contaminated with 15 mg/m^3 of HCHO for 7 days for testing their removal ability inside a sealed glass box ($1 \times 1 \times 0.8 \text{ m}$). After 7 days, the plants were classified into five grades (0–4) according to the damage response caused by formaldehyde. Grade 0 was normal with no damage and grade 4 with deterioration in the stem region and half of the leaves were rotten or dried (Zhou, Qin, Su, Liao, & Xu, 2011). The results listed the best 10 plants having high purification ability toward formaldehyde with the least damage (Zhou et al., 2011). In another independent study, the morphological response of the plant toward formaldehyde

by testing 15 hydroponic plant species in an automatic fumigation chamber was studied. Plants were exposed to 10, 50, and 100 mg/m³ HCHO for 1 h a day, for 6 days. Symptoms of plant damage were classified into four groups. Plant withered, leaf tips withered, foliar injury and leaf withered but stem upright. These results listed the best five tolerating and performing plants that came out to be: *S. floribundum*, *A. cucullata*, *D. bullata*, *S. podophyllum*, and *S. octophylla* (L. Wang et al., 2020).

2.6 Summary of formaldehyde phytoremediation studies

The NASA in the 1980s was the first in studying the efficiency of plant-based remediation for purifying indoor polluted air and improving IAQ (Lee et al., 2021; Moya et al., 2019; Wolverton, McDonald, & Watkins, 1984). NASA studies explored the harnessing potentials of indoor ornamented potted plants to be used in interior landscaping could purify the indoor air from various gaseous pollutants such as formaldehyde, benzene, and trichloroethylene. It can act as a precious eco-friendly treasure fighting to reduce concentrations of indoor air contaminants (Riggs, 2013; Wolverton, Johnson, & Bounds, 1989; Wolverton et al., 1984; Wolverton & Wolverton, 1993). Since Wolverton's studies, diverse ornamental potted plants have attracted researchers' attention to be selected for airtight experiments to test their removal rate and purification capacity against gaseous pollutant. Indoor ornamental potted species *C. elegans* (plant-soil system) was chosen to measure the removal capacity of HCHO in an air-tight Plexiglas chamber using various HCHO concentrations (0.66–11.7 mg/m³). As a result, the plant effectively removed 65–100% of HCHO from polluted air in the experiment during long time exposure and **Figure 2.10A** displayed the experimental setup utilizing spectrophotometer machine to measure the HCHO purification levels (Teiri et al., 2018a). Same experimental procedures were conducted on *N. obliterated* an indoor potted plant which effectively removed 90–100% of HCHO vapors from the contaminated air in the sealed chamber at a concentration (0.63–9.73 mg/m³) (Teiri et al., 2018b).

Further studies in sealed chamber reveal that the plant exhibits excellent efficiency and can be useful in cleaning indoor new or renovated spaces from formaldehyde. Another crop of three indoor ornamental plants was investigated using the fumigation method to evaluate their ability to clean off indoor HCHO. During 24 h exposure, the HCHO level was decreased from 1.65 to 1.22 mg/m³. The results revealed that *C. comosum* (0.63 mg/m³) and *A. americana* (0.62 mg/m³) had

more superior power to eliminate HCHO than *A. modestum* (0.13 mg/m³) (H. Zhao, Hao, & Xia, 2010). The results of fumigation experiment (in sealed stainless steel, and glass chamber, 1 m³) involving two indoor potted plants *E. aureum* and *R. japonica* showed that stems and leaves as main aerial parts could both effectively purify HCHO from the air. The stem's purification rate was 40% and 61.6% while, for leaves it was 74.4% and 71.8%, respectively (Zuo, Wu, Yu, & Yuan, 2022). Five indoor potted plants were chosen to analyze their formaldehyde adsorption capability using the airtight environment. The results revealed that the decrease in HCHO concentration was 0.33 mg/m³ after 12 h exposure to 37% formaldehyde solution. The order of the plants according to their effectiveness in purifying HCHO was observed to *S. trifascita* (1.90 mg/m³), *E. aureum* (1.87 mg/m³), *C. comosum* (1.78 mg/m³), *F. elastic* (1.27 mg/m³), and aloe vera (0.64 mg/m³) (Xiong & Su, 2009). Following the same experimental procedure, 3 plants were tested in airtight bins for their efficiency against the same pollutant. Leaves and root-basin soil were sealed, after 12 h exposure to 40% solution, the leaves' absorption capability was found in the order: *S. kochii* > *C. makoyana* > *E. aureum*. While the roots-basin soil adsorption capacity was found in a different order *C. makoyana* > *S. kochii* > *E. aureum* (Song & Xie, 2010). The leaves were the dominant part in absorbing the specific pollutant among the three tested plants, while *S. kochii* presented the highest 12 h HCHO adsorption capacity (the mass of absorbed HCHO per leaf area per hour) at 0.086 mg/m²/h. The tolerance level of a plant is a direct measure of HCHO remediation from the ambient air. If a plant has more powerful tolerance to formaldehyde, it has greater ability to purify indoor air (Han et al., 2022). In fact, the chlorophyll amount inside plants is degraded by air pollutants. It has also been proved that chlorophyll degradation in plants could be used to calculate roughly its anti-pollution capability (Rabe & Kreeb, 1979). Results of three potted indoor plants in relation to their chlorophyll contents revealed that the plants performed in order of *C. comosum* > *A. modestum* > *A. American* (H. Zhao et al., 2010). In another enclosed experiment against formaldehyde contents, 4 indoor decorative plants were able to decrease the concentration of formaldehyde by similar percentages ranging from *H. helix* 88%, *C. morifolium* 84%, *D. compacta* 96%, and *E. aureum* 94% during 24 h exposure and **Figure 2.10B** displayed the experimental setup utilizing formaldehyde monitor to measure purification levels of this particular pollutant (Aydogan & Montoya, 2011).

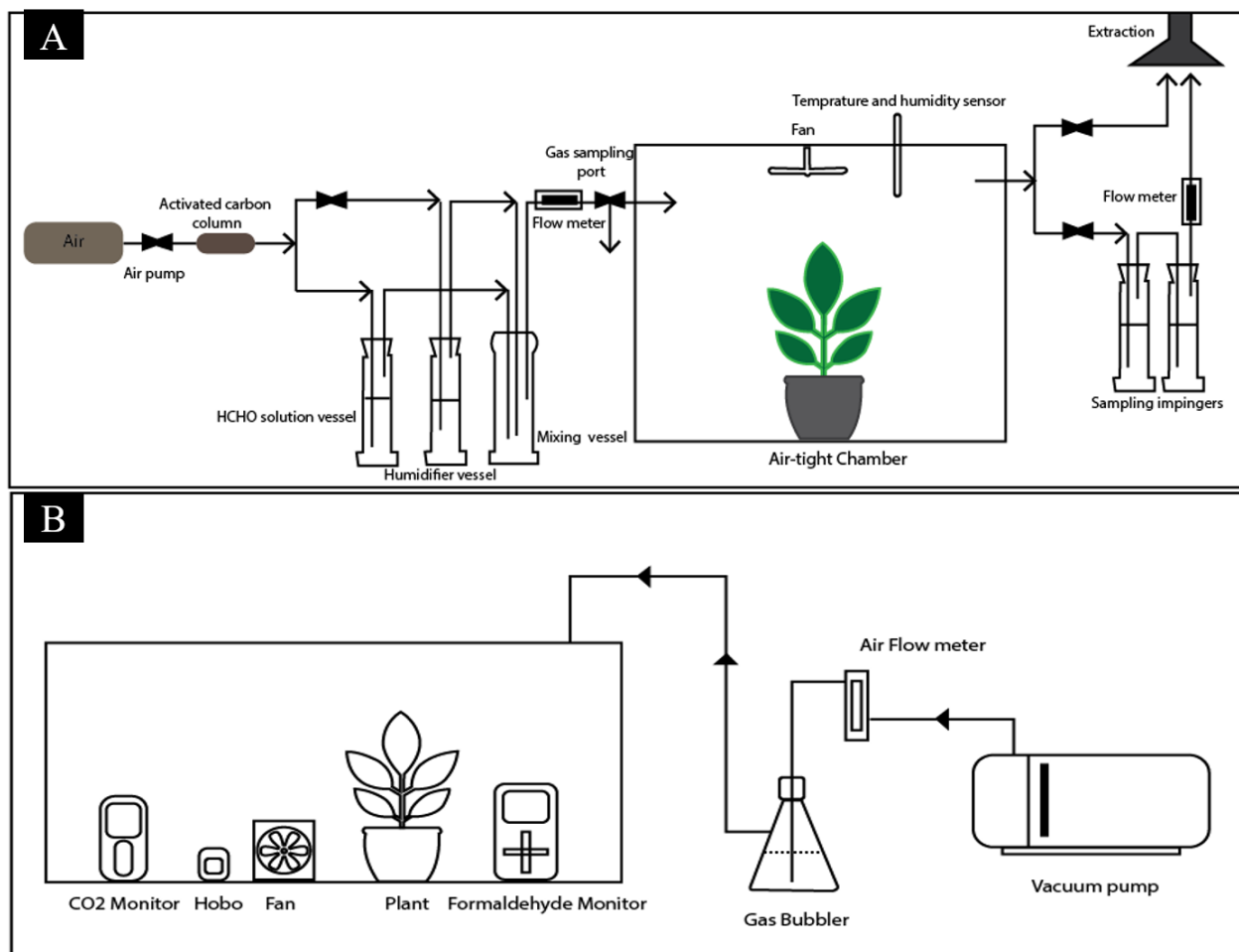


Figure 2. 10 Two experimental setup of the HCHO phytoremediation experimental studies. A: the experimental setup utilizing spectrophotometer machine to measure the HCHO purification levels (Teiri et al., 2018a). B: the experimental setup utilizing sensor to measure the HCHO purification levels (Aydogan & Montoya, 2011).

A recent study on *E. aureum* and *R. japonica* with 41 and 61% formaldehyde removal capacity was conducted and the enhanced efficiency of plant species was linked to the increased concentration of CO₂ during the experiment in a sealed environment. An increase in the concentration of CO₂ after efficient uptake of formaldehyde by the plant indicates its phytodegradation capability against HCHO. Roots and leaves of plants were found to be active in remediation while the role of the stem is still to be explore (Zuo et al., 2022). The plant, *S. wallissii* was tested in a 1 m³ static glass chamber for its capacity in removing indoor HCHO (Ghate, 2020).

Data were collected twice at the beginning of the experiment and after 24 h. Results showed that *S. wallissii* can remediate HCHO to improve IAQ as the HCHO level was reduced from 40.998 to 0 ppm (Ghate, 2020).

Another study was aimed to study HCHO removal using three hydroponic plants *T. zebrine*, *A. vera*, and *V. radiata* with the addition of cultured microorganisms to the rhizosphere (Yang et al., 2020). The experiment was conducted in a laboratory using a glass container (50×30×35 cm) for 24 h. The results showed that using a plant-microbial system enhances the removal capacity by 6.7–90.5%. The *A. vera* has the lowest removal capacity $18.8 \pm 0.21 \text{ mg h}^{-1} \text{ g}^{-1}$ without microbes vs. $23.1 \pm 4.2 \text{ mg h}^{-1} \text{ g}^{-1}$ in the presence of microbes. While *T. zebrine* and *V. radiata* showed even greater capacity of 59.3 ± 0.2 vs. 86.4 ± 0.7 and 25.1 ± 4.2 vs. $97.6 \pm 0.9 \text{ mg h}^{-1} \text{ g}^{-1}$, respectively. Cooperativity studies of plants and microorganisms indicate that >90% degradation can be achieved efficiently. Among six selected plants, *L. esculentum* and *H. annuus* were very efficient in the removal of HCHO (S. Zhao et al., 2019). Such studies clarify a new direction in the field to get information about cooperation between plants and microorganisms in rhizosphere solutions (microbe-plant system). The most efficient plants in HCHO remediation are summarized in **Table 2.5**.

Plants survive under a complex natural environment and a minor factor can adversely affect their efficiency towards certain function. It is obvious that plants in natural environment could decrease the CO₂ concentrations through photosynthesis (Zuo et al., 2022). In this process, CO₂ gas entered the plant directly through the open stomata on leaves' surface in the presence of sunlight and water to produce oxygen and glucose. However, CO₂ concentrations inside the box showed a rising trend, as HCHO gas entered the plant directly via the open stomata on the leaves' surface or infiltrated into the plant via the epidermis covered by cuticular wax, some HCHO would be oxidized to CO₂ by methylotrophic bacteria into amino acid. Then the CO₂ resulted from the process of formaldehyde degradation, enters the Calvin cycle thus acting as new alternative source for CO₂ for photosynthesis along with normal plant respiration (**Figure 2.7**). The Calvin cycle is a set of dark reactions that happen during photosynthesis and carbon fixation to convert CO₂ into glucose, sucrose, or starch (Bäck et al., 2013; Firooznia, 2007). These processes reduce the plant ability to absorb CO₂ inside the air-sealed chamber resulting in clear increase percentage. Kim et al stated that plants are well acknowledged for their ability to absorb formaldehyde and metabolize it (K. Kim et al., 2010). Furthermore, for being able to enter *via* stomata and the cuticle,

formaldehyde may be more readily absorbed by younger leaves and by the underside surface of the leaves. Once HCHO gas enters the plant, it is oxidized by two-step enzymatic oxidation reaction to form CO₂ and it is approximately five times faster during the daytime than night (Ghate, 2020, 2021; K. Kim et al., 2010). Moreover, it has been determined that formaldehyde enters *via* open stomata and get oxidized to CO₂, passed to the Calvin cycle and is converted into either a source of carbon for photosynthesis or another combination as amino acids, organic acids, sugar, and water (Khalifa et al., 2023; Teiri et al., 2020). Moreover, some researchers have stated that the most desirable removal mechanism for formaldehyde is being decomposition into harmless elements such as amino acids, free sugar, lipids, organic acids etc. (K. Kim et al., 2010; Teiri et al., 2018a; Zhongjun Xu, Li Wang, & Haiping Hou, 2011). It has also been stated that HCHO is a hydrophilic gas, thus could not diffuse *via* the cuticle smoothly as it consists of lipid (Teiri et al., 2018a). Similar upward trend was resulted from recent research of Zuo and coworkers as the capacity of the plant to uptake CO₂ from air was reduced and elevated CO₂ concentration was accumulated inside the box during the experiments (Zuo et al., 2022). The increase of CO₂ levels is positively correlated with the quantity of HCHO being taken up by the plant. Furthermore, the change in CO₂ levels could be utilized to reflect the progress of the purification process of HCHO within the box (Zuo et al., 2022).

Literature lack studies on phytoremediation of HCHO in the Kingdom of Bahrain or the other neighboring countries under ambient conditions. The second part of this study is dedicated to explore the efficiency of the selected ornamental non-native indoor potted plants toward purifying HCHO under laboratory conditions.

Table 2. 5 Summary of active and passive plant systems towards pollutants removal. Results summarized from laboratory-based experiments.

No.	Plant species (treatment/system)	Experimental				Ref.
		Conditions	Sampling methods/ tools	Time	Summary / removal rate	
1	<i>Spathiphallum wallissii</i> Regal (PP/P)	Sealed glass chamber	Advanced formaldehyde detector	24 h	Formaldehyde reduced from 4.998 ppm to 0 ppm.	(Ghate, 2020)
2	<i>T. zebrine</i> , <i>A. vera</i> , <i>V. radiata</i> (HP/P)	Clear glass container	UV Spectrophotometry and automatic formaldehyde detector	24 h	Formaldehyde removal rate was increased by 6.7 – 90.5% using plant with microbe system	(Yang et al., 2020)
3	<i>C. comosum</i> <i>Aloe vera</i> <i>E. aureum</i> (PP/P)	Dynamic chamber, cylindrical Plexiglas.	Formaldehyde analyzer (4160, Interscan Co.)	3 d	95% 53% 84%	(Z. Xu et al., 2011)
4	<i>N. exaltata</i> , <i>C. morifolium</i> , <i>P. roebelenii</i> (PP/P)	Airtight cubical plastic chamber	Sensidyne-Gastec air sampling pump and gas detector tubes.	24-72 h	1863 µg/m ³ h 1450 µg/m ³ h 1385 µg/m ³ h	(Wolverton & Wolverton, 1993)
5	<i>F. japonica</i> , <i>P. F. benjamina</i> (PP/P)			5 h	Day: 39%; Night: 98% Day: 57%; Night: 94%	(K. J. Kim et al., 2008)
6	<i>H. helix</i> (PP/P)	Acrylic quasi-closed box	Combo air quality sensor (AQM-100 and APM-200, AIGO TECH Co.)	67.6 h	99.99%	(Chen, Lin, & Chuah, 2017)

7	<i>H. helix</i> <i>C. morifolium</i> <i>D. compacta</i> <i>E. aureum</i> (PP/P)	Clear glass chamber, cover made from Lexan	Formaldehyde monitor (HFX 105, Hal Technology)	24 h	88% 84% 96% 94%	(Aydogan & Montoya, 2011)
8	<i>C. comosum green</i> green and white purple (PP/P)	Dynamic fumigation system made from Tedlar bags	Formaldehyde detector	7 d	GC: Day: 71.07% $\pm$ 0.23; Night: 36.21% $\pm$ 0.24 CC: Day: 84.66% $\pm$ 0.19; Night: 62.15% $\pm$ 0.19 PC: Day: 46.73% $\pm$ 0.15; Night: 34.97% $\pm$ 0.11	(Li et al., 2019)
9	<i>N. exaltata Schott</i> (ALW/A)	Closed fumigation box	5 in 1 air quality detector	6 h	- The active airflow mode removed 33% more formaldehyde than the non-exhausted mode. When comparing with commercial air purifier, ALW reduced CO ₂ . More than air purifier but it reduced PM _{2.5} and PM ₁₀ more efficiently.	(Hung, Chen, Yeh, & Tseng, 2019)
10	<i>Epipremnum aureum</i> (PP/P)	Sealed fumigation box			- The efficiency of removal by the stems was 0.089 mg·m ⁻³ ·h ⁻¹ - The rate of purification was 40.0%	(Zuo et al., 2022)
11	<i>Rohdea japonica</i> (PP/P)	Sealed fumigation box			-The efficiency of removal by the stems was 0.137 mg·m ⁻³ ·h ⁻¹ - The rate of purification was 61.6%	

Abbreviations in the Table: Passive system (P), Active system (A), Potted plant (PP), Green wall (GW), active living wall (ALW), active botanical biofilters (ABB), botanical indoor air biofilters (BIAB), Hydroponic plant (HP), Dynamic Botanical air filters (DBAF)

Chapter 3 Methodology

The current study aims to clarify directions to reach an environmental and sustainable interior design (ESID) by focusing on main elements that exist in the interior environments and contribute to the formation of indoor air pollution which are interior finishing materials. This study investigated the availability of EFIMs in the local market as it is considered the optimum and recommended method to mitigate the IAP issue. This study also investigates the role of indoor potted plants in reducing the levels of indoor gas pollutants and enhancing the quality of indoor air via laboratory experiment using air-sealed glass box.

3.1 Eco-friendly interior materials (EFIMs)

3.1.1 Study sample

The study sample, $n = 30$ represents local supplier stores for interior finishing materials such as ceiling, wall, and floor covering. It was categorized as high-class interior material stores, Collective Mega stores for many interior materials, Specific stores supplying one or more interior materials items, furniture stores, interior design offices, and local shops supplying local products (Figure 3.1).



Figure 3.1 Classification of interior materials suppliers in Bahrain.

Details of the n=30 interior materials supplier stores (**Table 3.1**) with their location area and the coordinates (longitude and latitude) for clarity and accuracy purposes (source of coordinates is from google maps).

Table 3.1 List of the 30 EFIMs stores that were visited during this study with their coordinate's location (longitude and latitude).

	Store name	Located in	Coordinates
1	Danube Home	Salmabad	26.178478150534726, 50.53857530625641
2	Home Centre	Oasis Centre, Riffa	26.13679841899858, 50.56978349696921
3	Dream Home Furniture	Salmabad	26.18141432007992, 50.53702120648593
4	Chateau Interiors	The Design Hub, Salmabad	26.18118430459139, 50.53711241206479
5	Homes r us	South Sehla	26.20355648644705, 50.5353190748782
6	Boconcept	Seef	26.241275864536565, 50.53769443215955
7	Cattelan italia	The Design Hub, Salmabad	26.18118430459139, 50.53711241206479
8	Ashley Furniture Homestore	Al Musalla	26.207670505387412, 50.54068915043033
9	Magic Interior	Al Musalla	26.207465253462853, 50.54161431872833
10	Ahmed Sharif Furniture	South Sehla	26.2049° N, 50.5375° E
11	Manazel	Salmabad	26.18252159624825, 50.53661852621711
12	Omega paints	Salmabad	26.184553720227388, 50.536333378236215
13	Al-Haiky factories	South Sehla	26.20502311163331, 50.53689943820853
14	D.House	City Centre Bahrain	26.233515349726975, 50.55528118077475
15	IDdesign	Seef district	26.238752421050048, 50.53455047516788

16	Phoenicia Decor	Seef Mall	26.232885783862514, 50.53783480048567
17	Pieces Furniture	Al A'ali Mall, Manama	26.2328905997874, 50.54045643646731
18	Rugland	City Centre Bahrain	26.2325° N, 50.5541° E
19	Carpetland	Tubli	26.2028° N, 50.5634° E
20	Home Box	Marina Mall, Manama	26.22958931255899, 50.56400916224071
21	Kavalani & Sons.	Al Hidd	26.20810487136833, 50.68300239631197
22	Al Yusuf Decor	Tubli	26.190896796593336, 50.537042752703705
23	KENZ	Tubli	26.202903132483414, 50.56352009942394
24	Zara Home	Bahrain City Center, Manama	26.23331249595441, 50.55399230476489
25	Marina Home	Seef Mall Seef District	26.234202311395357, 50.53808250097155
26	The One	Al A'ali Mall, Manama	26.2332691763657, 50.539446616336036
27	IKEA	Salmabad	26.1799° N, 50.5046° E
28	Pottery barn kids	The Avenues, Manama	26.2457° N, 50.5851° E
29	Pottery barn	The Avenues, Manama	26.2457° N, 50.5851° E
30	West Elm	The Avenues, Manama	26.2457° N, 50.5851° E

The interior materials stores exist inside shopping malls and in commercial zones located in different areas of Bahrain, concentrated mainly in the northern areas such as Seef district, Manama, Salmabad, and Tubli (**Figure 3.2**).



Figure 3.2 Bahrain's map showing the locations of the 30 EFIMs supplier stores.

3.1.2 Data collection methods

The current study develops a comprehensive understanding pertaining to the EFIMs properties along with a study related to their availability in the local market to reach ESID practices. Thus, four primary and secondary research methods are undertaken; which involve in-depth data gathering from existing resources and from the local suppliers following the literature protocol (Hayles, 2015) (**Figure 3.3**):

- 1- Literature study of available EFIMs, its properties, and eco labels certifying it.

- 2- Observation (non-participant structure) of availability of EFIMs.
- 3- Survey for supplied EFIMs in the local market.
- 4- Semi structured interview with retails.
- 5- Semi structured interview with interior designers.

3.1.3 Literature study

A literature study about EFIMs and its properties to be selected for ESID practices was undertaken to initiate a comprehensive understanding about these materials and the eco labels, certifying its properties. This secondary research method enables to collect in-depth data from available resources while effectively saving time and cost (Hayles, 2015).

3.1.4 Observation

Non-participant observation was carried out in retail stores (n= 30) that supply products for interior design projects. This involved documenting self-information through observations, including taking notes and photographs inside these establishments. This method depends the most on firsthand observation of the materials' properties as presented on tags, cards or sometime on the suppliers' website. This primary research method involved gathering up to date data from existing resources and from the local suppliers which were undertaken by previous research work (Hayles, 2015). In the current study a selected sample of interior finishing materials suppliers, categorized as high-end stores, specific interior material stores, stores in shopping malls and interior design offices were more appropriate than random sample due to the nature of the study (Hayles, 2015).

3.1.5 Survey

A survey of the available EFIMs was conducted in stores (n=30) that supply interior finishing materials for interior design works. This method depends on the personal engagement with the displayed products and retailers to collect reliable, in depth primary data which were undertaken by previous research work (Hayles, 2015). The literature study results were performed to categorize the EFIMs for analysis. All stock inside these stores were surveyed to discover whether EFIMs are available for sale, and if so, the need to be categorized correctly. Moreover, attempts were made to establish the eco-labels related to it.

3.1.6 Semi-structured interviews with retailers

Semi-structured interviews were conducted with the mentioned interior materials retailers to check their knowledge about the availability and properties of EFIMs and their clients' needs for EFIMs if it exists in their respective stores. Retailers were first asked if they retail EFIMs in the store (**Appendix B**). If they answered (Yes), they were asked to further describe properties of these products. If they answered (No) and they did retail EFIMs, they were shown the materials and were convinced for considering this material as EFIMs. However, if they answered 'No' and they did not retail EFIMs in their store, they were asked about reasons for not retailing EFIMs. Furthermore, retailers were asked if clients ever request EFIMs; whether they consider there was a need for EFIMs; and whether they encouraged clients to buy EFIMs. Then, they were asked whether they believed the well-being and the environmental benefits of utilizing EFIMs are widely recognized by their clients. Lastly, they were asked about the barriers they thought that clients buying EFIMs faced.

3.1.7 Semi-structured interviews with interior designers

A semi-structured interviews were conducted with 5 interior designers from the market and they were asked five questions related to EFIMs availability in Bahrain and the clients attitude concerning it (**Appendix C**). Interior designers were first asked whether EFIMs are available in Bahrain or otherwise. Then, they were asked if they use EFIMs in their interior design projects. Furthermore, interior designers were asked if their clients ever request EFIMs; and whether they think that their clients are aware of the importance of EFIMs or not. Lastly, they were asked about the barriers they thought that clients buying EFIMs faced.

3.1.8 Data analysis

Collected data were organized into detailed tables and then analyzed and represented into graphs using Microsoft Excel Program. The SWOT analysis for current case of availability of EFIMs in Bahrain local market are undertaken.

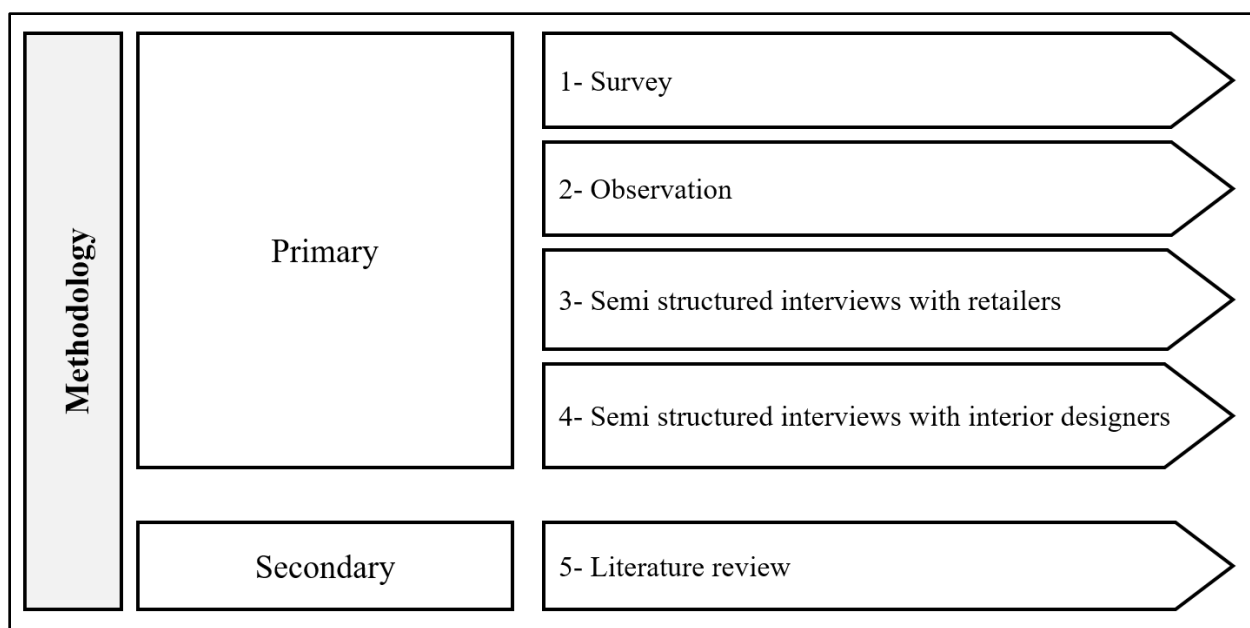


Figure 3.3 A flowchart showing the methodology of the EFIMs study.

3.2 HCHO phytoremediation by indoor plants

3.2.1 Test chamber

An air sealed glass box (1 m^3) was designed, from unbreakable glass within an aluminum frame with a front door and three holes therein, to provide an access to the box during experiment (**Figure 3.4**). Moreover, two holes, one each on the right and left sides of the box serve as inlet and outlet during the experiments. The inlet port is located on the bottom left side of the box (0.4 cm diameter) about 15 cm from the bottom level. It allows inflow of the gas pollutant inside the box. While the outlet port is located on the top of the right side of the box about 15 cm from the top level. It is linked to vacuum line to ventilate the box after each experiment. Sealing material silicone was applied to ensure airtightness of the box. The USB cables of the sensor devices were passed through the provisions in the front door. Following the literature procedure, all precautionary measures were adopted throughout the experiments to avoid leakage and keep the box airtight all the time (K. Kim et al., 2010; Teiri et al., 2018a; Zuo et al., 2022). Furthermore, the box was tested to retain concentration of the pollutant constant for at least 24 h, without the test plant. Air tightness of the fumigation box was checked before each experiment.

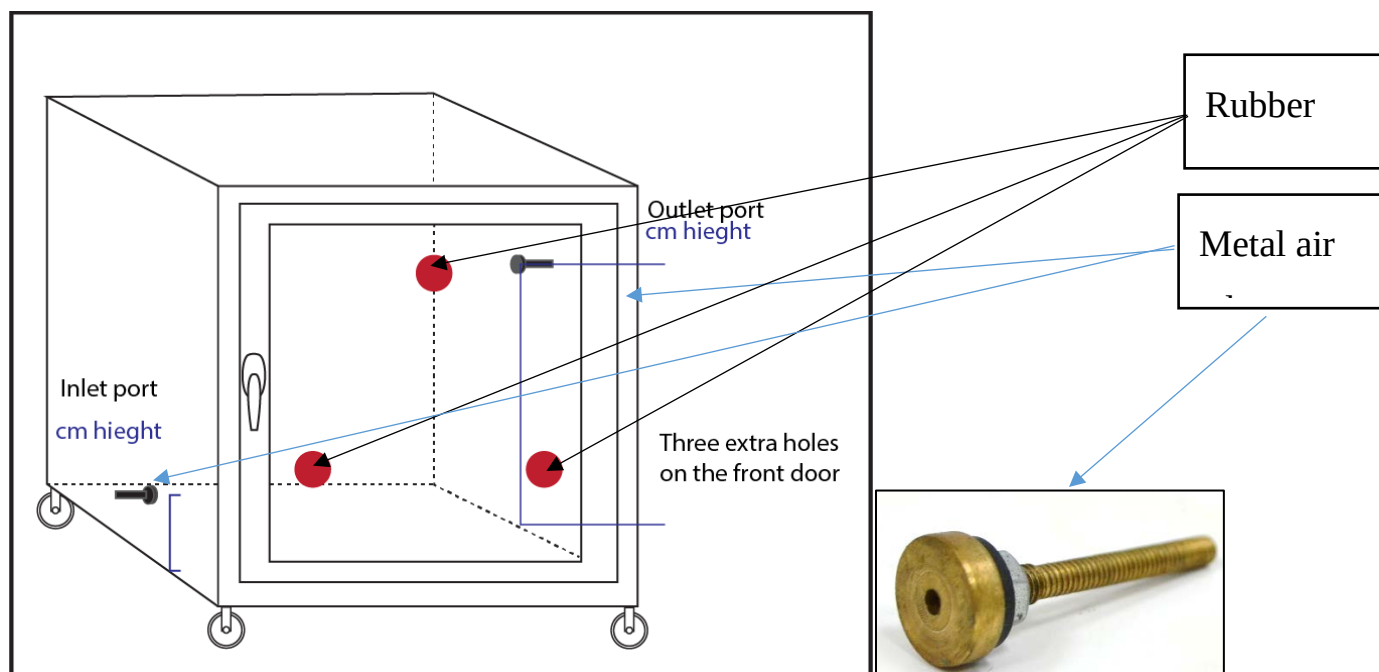


Figure 3.4 Details of the glass box and adaptors used in the experiment.

3.2.2 Plant materials

Three potted plant species namely *E. aureum*, *C. comosum*, and *S. wallisii* each one less than one year old, were selected from the market and were used in the experiment (**Table 3.2** and **Table 3.3**). Plant species were selected on the bases that they are common decorative indoor potted plants used globally inside built environments (Aydogan & Montoya, 2011; Wolverton & Wolverton, 1993). These are among the most popular studied species in several parts of the globe (Chatakul & Janpathompong, 2022). The plants were acclimated to the lab indoor environment for more than 2 months at $20 \pm 1^\circ\text{C}$, and $75 \pm 5\%$ relative humidity and were watered with 300 mL water once a week from tap water. Three plants of each species were grown under identical environmental conditions. Two plants were exposed to formaldehyde vapors for specific time followed by 24 h rest, and the third plant was kept as control, placed in formaldehyde-free air in a normal laboratory environment.

Table 3.2 Properties of the selected Indoor potted plants in this study.

Botanical name		Common name	Origin and family	Average height	Pot diameter
A	<i>Epipremnum aureum</i>	Pothos plant	Southeastern Asian plant of the arum family (Araceae)	25 cm	22 cm
B	<i>Chlorophytum comosum</i>	Spider plant	African plant of the asparagus family (Asparagaceae)	45 cm	22 cm
C	<i>Spathiphyllum wallisii</i>	Peace lily	Tropical regions, mainly in Central and South America. A member of the Araceae family.	30 cm	22 cm

Table 3.3 Characteristics and growing factors of indoor potted plants selected for this study (Hessayon, 2001)

Indoor plant name	General information and growing factors
<i>E. aureum</i>	Type: evergreen foliage indoor plant with thick, waxy, green, heart-shaped leaves with splashes of yellow
	Temperature: 24-27°C
	Humidity: 40-60%
	Water: Moderate
	Light: Bright indirect light

	Origin: native to southeastern Asia
<i>C. comosum</i>	Type: evergreen foliage indoor plant with long narrow leaves is located at the base of the plant arising directly from the roots
	Temperature: 18-24°C
	Humidity: more than 30%
	Water: Low
	Light: Bright indirect light
	Origin: native to tropical and subtropical regions of Africa, Asia, and Australia
<i>S. wallisii</i>	Type: green foliage indoor plant making clumps. Leaves are green and while flowers are a succession flowerlike leaf
	Temperature: 20-24°C
	Humidity: more than 50%
	Water: Moderate
	Light: Indirect light
	Origin: Tropical regions

3.2.3 Formaldehyde vapors generator, real-time instrument data logger, and other devices.

The polluted air with HCHO was generated by bubbling 37-41% formaldehyde solution (BDH, England), by injecting an appropriate amount to raise the reading to ~3 ppm inside the box. Formaldehyde concentrations were measured by using IQ-610 Direct Sense Probe (IQ-610, Gray

Wolf Sensing Solutions, USA) (**Figure 3.5**). It was used to give real-time readings for HCHO, CO₂, temperature, and relative humidity after 15 min as stabilizing time. The device was calibrated before using for data collection (**Appendix D**). The sensing probe connected to the computer was kept inside the fumigation box and the data were recorded for each 1 min interval during experiments. In the PC, different commands in the program of the IQ-610 sensor were used with different user interface on PC as visually presented in

Table 3.4 such as live view window, which showed real-time readings. Data logging window with several options was used to select location of data file, name, and time interval (**Table 3.4**). This data can be accurately converted into Microsoft Excel format and exported to other appropriate software for further analysis.



Figure 3.5 Gray Wolf Indoor Air Quality meter (IQ-610, Gray Wolf Sensing Solutions, USA).

Following the reported protocol, the data related to HCHO (concentration in ppm), CO₂ (ppm), temperature (°C), and relative humidity (%) was monitored and the respective values were noted (Aydogan & Montoya, 2011; Ghate, 2020, 2021; Li et al., 2023; Teiri et al., 2018a; Zuo et al., 2022). Change in concentration of these parameters was taken up as remediation efficiency of the plant species. A PC connected electrochemical formaldehyde sensor HAL-HFX205 (HFX 205, Hal Technology, USA) (**Appendix E**) fitted with temperature and humidity sensing probes was used in parallel to monitor the HCHO concentration (Aydogan & Montoya, 2011). Since the sensor cannot measure data for longer time due to some technical reasons, it was used only for validation purposes. An alternate formaldehyde meter (FP-31G, Gray Wolf Sensing Solutions, USA) was utilized to detect HCHO gas leakage (if any) from the box into the lab and was installed close to the experiment box. It runs tests for 15 or 30 min to show the possible presence of formaldehyde in the surrounding. Other devices used are an external vacuum pump (CAPEX L2C, C2617, USA), air flow meter (SHLLJ, SUNHUANLIU LIANGYIBIAO, China), an axial DC fan (Axial fan, AC 220 V, Model 12038A2HBL). Furthermore, LED linear fixture was used to provide a 12 h cycle of day/night illumination (LED Purification fixture, Image Spain Lighting, 54 W) and the digital light meter (UT383S, UNIT-T, China) (**Table 3.5**).

Table 3.4 User interface of the Wolf sense program showing three main commands: 1) Main window showing live readings (real-time), 2) logging window, and 3) Review window showing the data logged in a table format.

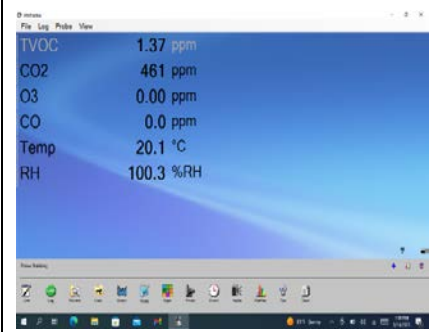
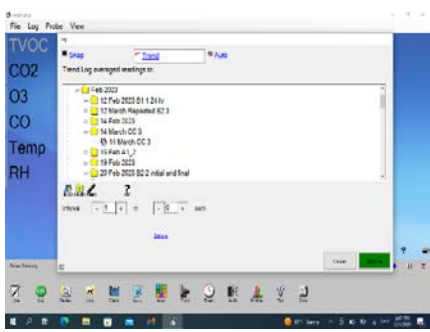
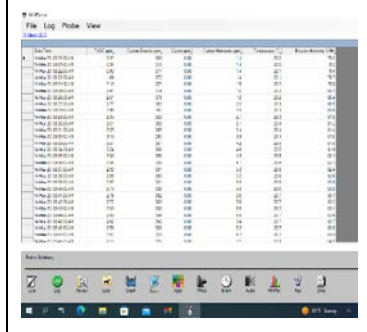
1- Live view window	2- Logging window	3- Preview window
		

Table 3.5 Chemical, devices and tools used in conducting the lab experiments.

			
Formaldehyde sensor from HAL-HFX205	Formaldehyde meter FP-31G from GreyWolf.	HCHO solution	Vacuum pump
			
Air flow meter	LED light	Axial fan	Digital light meter

3.2.4 Optimization of the test chamber

The HAL-HFX205 helped toward optimizing the HCHO gas level inside the box. An appropriate amount of HCHO solution (~1 mL) was bubbled for 10 min inside the air sealed box. Before bubbling HCHO, the concentration of HCHO was measured to be 0 ppm and the concentration gradually raised as bubbling proceeded. After the optimum bubbling time of 10 min, the fan was switched on for 20 min to better mix the air inside the box. The fan was turned off after 30 min to avoid the generation of extra heat and any possible VOCs according to the literature procedure (Zuo et al., 2022).



Figure 3.6 Overall experimental system: air-sealed chamber and attached instruments.

3.2.5 Experimental setup

Experimental set up during this study is represented in Figure 3.6 and Figure 3.7. Triplicate tests were performed for each experiment and the values were averaged. Without potted plant in the box, an experiment was run to determine the change in HCHO concentration in the chamber to

know about leakage/adsorption/absorption, if any. When it was confirmed that there is no leakage, evident by no change in concentration of HCHO, the box was carefully opened, and the selected plant was placed inside. All the devices needed were connected properly, after stabilizing the instruments, the HCHO bubbling process was started as stated earlier. After 30 min, the axial fan was turned off and the data was recorded. Data logging was performed using 1 min interval continuously for 5 h, 7.5 h and 24 h as elaborated in recent research paper (**Figure 3.8**) (Irga et al., 2018). During these experiments, the average temperature inside and outside the air-sealed glass chamber during the experiments was $22^{\circ}\text{C} \pm 1.5^{\circ}\text{C}$ and $20^{\circ}\text{C} \pm 1^{\circ}\text{C}$, the relative humidity was $72\% \pm 4.5\%$ and $50\% \pm 2\%$, respectively. Moreover, the light intensity was 1000 Lx , which is equal to $13.5 \mu\text{mol}/\text{m}^2/\text{s}^1$, photoperiod is 12 hr light cycle. These conditions were similar for all tested species. In control experiments, the potted plants were exposed to formaldehyde-free air under the same environmental conditions.

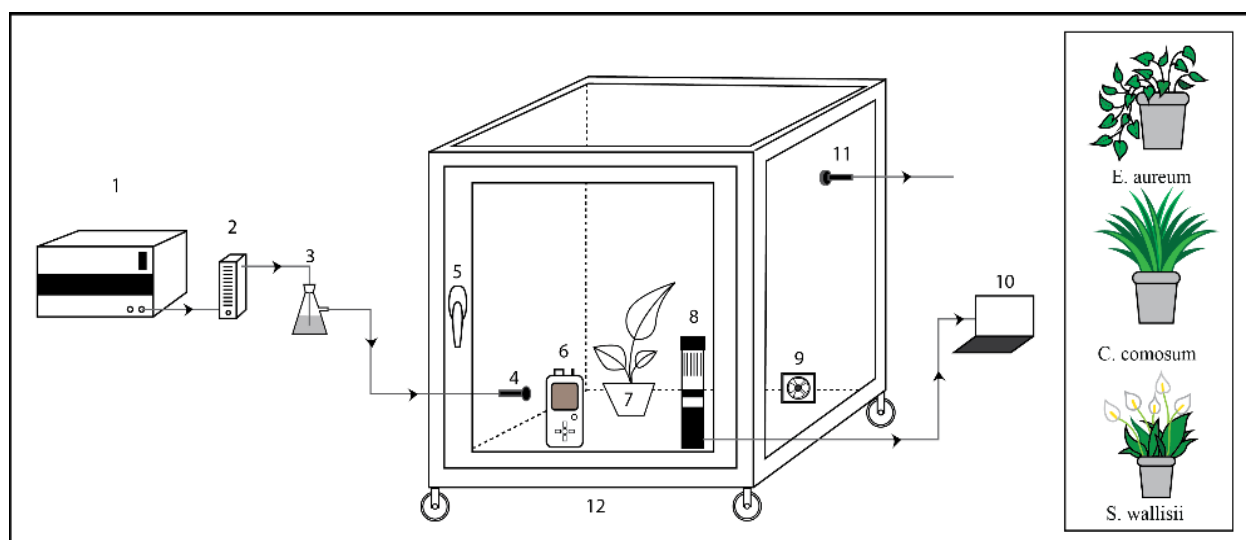


Figure 3.7 Schematic diagram of the experimental setup: (1) Air pump (2) Air flow meter, (3) Gas bubbler, (4) Inlet port with metal air adapter, (5) Sealing handle, (6) HCHO sensor, (7) Indoor potted plant, (8) IQ-601 probe, (9) Axial DC fan, (10) Tab for data logging, (11) Outlet port with metal air adapter for ventilation, (12) Air-sealed chamber. On the right side, illustrations of the tested indoor plants are also presented.

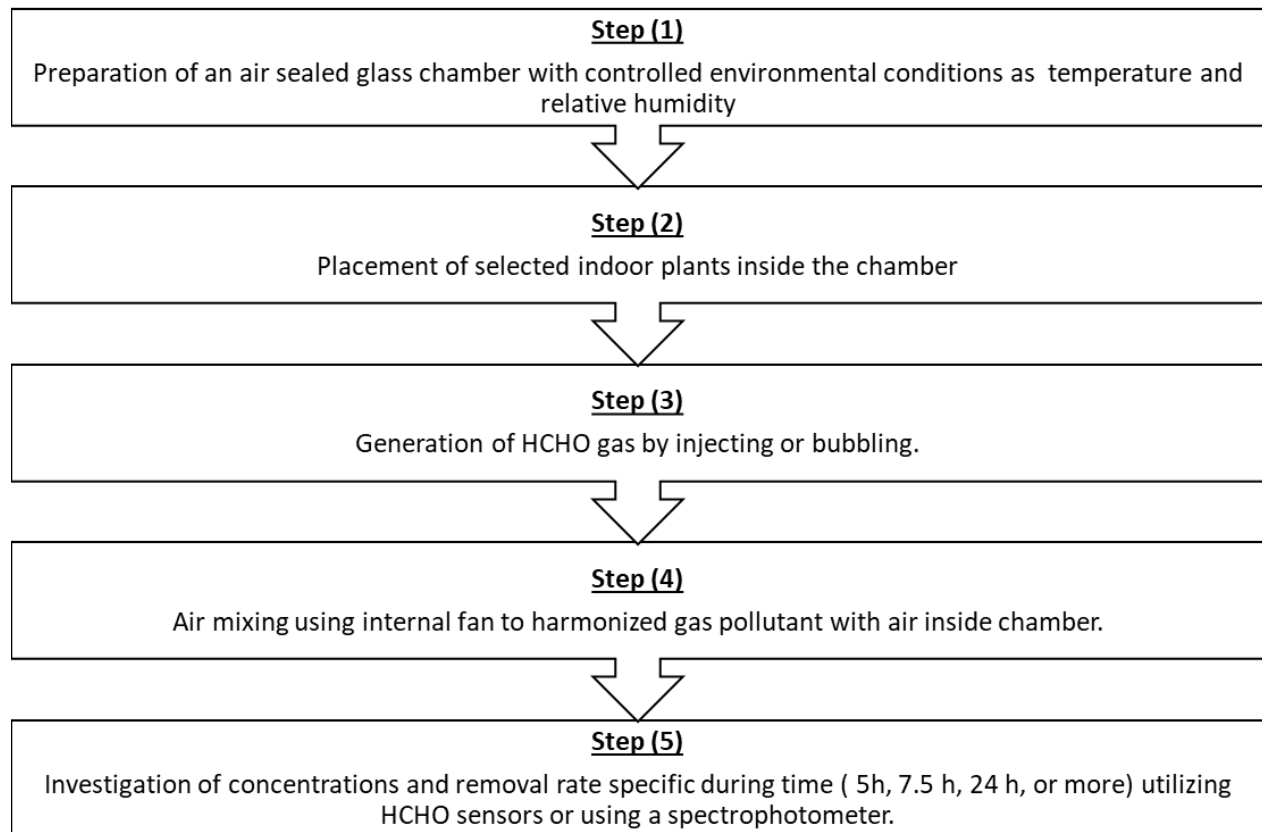


Figure 3.8 Summarized experimental steps to test the removal rate of indoor air pollutants via indoor ornamented plants. Adapted from (Irga et al., 2018).

3.2.6 Data analysis

Gas concentration unit, parts per million (ppm) was selected in the Gray Wolf real-time instrument. After each experiment, the logged data from the IAQ meter was exported and accordingly saved. The Excel files were analyzed and detailed tables and graphs were generated. The HCHO purification efficiency of each plant was evaluated using Eq. 1 (Aydogan & Montoya, 2011; Li et al., 2023):

$$((C_i - C_f)) / C_i \times 100 \quad \text{Eq. 1}$$

The percent amount of CO₂ was found to increase in each experiment, the increased percentage was evaluated using Eq. 2 (Zuo et al., 2022).

$$(C_f - C_i) / C_i \times 100 \quad \text{Eq. 2}$$

Where, C_i is the initial concentration and C_f represents the final concentration, in case of HCHO measurements the C_i is the concentration after 30 min of bubbling and uniform distribution (10 min bubbling and 20 min air mixing time).

3.2.7 Statistical Analysis

Statistical analysis was performed with IBM SPSS Statistics software (Z. Xu et al., 2011). One-way ANOVA analysis of variance test was applied to check if the means of the purification efficiency of the three selected plants species is significantly different from each other or otherwise (Hashim, Teh, & Rosli, 2019; Li et al., 2023; Z. Xu et al., 2011). Moreover, ANOVA test was applied to check the difference in concentration of CO₂ between single and double potted plants. The mean and standard deviation were calculated using a descriptive statistical method (Sharma, Bakht, Jahanzaib, Lee, & Park, 2022).

3.3 Plant morphology and visible injury.

Plant's height is one of the main characteristics of the plant morphology, which was measured before and after the experimental tests to assess the impact of HCHO on plants' growth. Two additional parameters were considered for each plant:

3.3.1 Visible injury

The plants were monitored for visible injury after 10 days of exposure where the leaves were inspected for any visible injury or symptoms as compared to the control plant. Nikon digital camera (Nikon DX) was used to take photographs of the leaves of the exposed and the control plants for better comparison and record.

3.3.2 Pollution Indication Index (PII)

It was calculated by counting the number of all the leaves divided by the number of injured leaves multiplied by 100, according to the formula given in Eq. 3 (Ghate, 2020, 2021).

$$PII = \frac{N_E}{N_A} \times 100 \quad \text{Eq. 3}$$

Where, N_E is the number of leaves exposed to formaldehyde and N_A is the number of affected leaves.

After 10 days of conducting the exposure experiments, all plants were carefully inspected for symptoms of any visible injury comparing the exposed set of plant to the control/healthy plant. Furthermore, PII was calculated, the pictures of visible damages of the tested plants' leaves and possible reasons of each damage/symptom are studied.

Chapter 4 Results and discussion

Towards achieving the aims, to study the EFIMs available in Bahrain local market and the purification efficiency of indoor potted plants to achieve environmentally sustainable interior design.

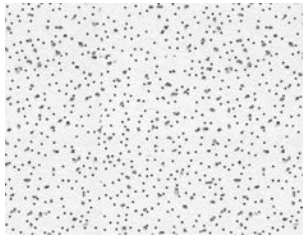
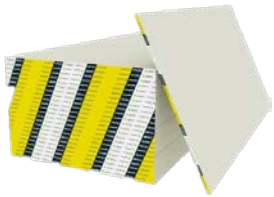
4.1 EFIMs

4.1.1 Properties and eco-labels.

The EFIMs studied herein are the materials used to finish the inner surface of the structural element that surround the interior space which are categorized into: ceiling finishing materials, wall finishing materials, and floor finishing materials.

Ceiling finishing material: It is the material covering the overhead interior surface of a built environment (ceiling). Which may be exposed or concealed with various other types of materials such as acoustical ceiling tiles, wood, and gypsum boards (**Table 4.1**) (Binggeli, 2014; Koca, 2016; Salci, 2019).

Table 4.1 Examples of ceiling finishing materials that have EFIMS characteristics.

Ceiling material	Acoustical ceiling tiles	Wooden panels	Gypsum boards
Photo			
EFIMs characteristic	Recycled content Low VOCs emissions	Recycled content Renewable source	Low embodied energy Durable
Ref.	(USGKnauf, 2021b)	(USGKnauf, 2021c)	(USGKnauf, 2021a)

Wall finishing material: It is the material covering the vertical surface of interior spaces at the eye level such as low VOCs paint, wood laminated panels, and wall paper (**Table 4.2**) (Binggeli, 2014; Riggs, 2013; Salci, 2019).

Table 4.2 Examples of wall finishing materials that have EFIMS characteristics.

Wall material	Low VOCs paint	Wooden panels	Wall paper
Photo			
EFIMS characteristic	Ultra-low VOC and emissions Free from harmful chemicals	Low embodied energy Low VOCs emission Renewable source	Natural materials No emissions Durable
Ref.	(Jotun, 2024)	(Greenlam, 2024)	(YorkWallcoverings, 2024)

Floor finishing material: Is the material on the top surface of a floor structure and divided into hard flooring such as wood and tiles, soft flooring such as carpet and rugs, and resilient flooring such as vinyl and rubber (Table 4.3) (Binggeli, 2014; Riggs, 2013; Salci, 2019).

Table 4.3 Examples of floor finishing materials that have EFIMS characteristics.

Wall material	Wood flooring	Carpet	Vinyl flooring
Photo			
EFIMs characteristic	Free from harmful chemicals Very low VOCs emissions	Renewable and natural source	Free from harmful chemicals Very low VOCs emissions
Ref.	(AGT, 2024)	(GreenBuildingSupply, 2024)	(Carpetland, 2022)

Literature study reveals that it is important to study the following characteristics (Yudelso, 2007) when determining whether or not the above finishing materials (ceiling, wall, and floor) can be considered as EFIMs:

- 1- Low embodied energy: It is the total energy consumed during the material entire life cycle from extraction, manufacturing, distribution, usage, maintenance, and disposal such as gypsum boards etc. (Binggeli, 2014; Ćurčić et al., 2019; Rashdan & Ashour, 2017).
- 2- Recyclable and recycled content: Reusing recovered available materials and turning it into a new materials which reduce the vast consumption of virgin materials and reduce the disposals sent to landfill (Alfuraty, 2020). Example of recycled content materials is carpet made from recycled plastics and recycled fibers (Hussein, 2012; Sheth, 2016).
- 3- Locally sourced materials: Supplying materials from less than 500 miles from the project location which support the local products and reduce the environmental impacts of transportation (Alfuraty, 2020; Hussein, 2012). To encourage this movement globally,

projects that use at least 10% of all building materials from local sources or from 500 miles radius were awarded point toward LEED certification (Sheth, 2016; Yudelso, 2007). Examples of locally sourced materials reclaimed wood, local factories of rugs, local stones and concrete (Hussein, 2012).

- 4- Durable materials: Using durable and long-lasting materials that can withstand various usage impacts inside buildings and continue functioning as it designed indoors such as wooden wall panels (Alfuraty, 2020; Rashdan & Ashour, 2017).
- 5- Natural and renewable materials: Utilizing materials that can quickly replenish themselves within a 10 years cycle or less and being harvested in a sustainable methods such as certified wood and bamboo floor (Hussein, 2012; Sheth, 2016).
- 6- No/ low emissions and toxics free: Materials contain neither VOCs nor toxins like HCHO and acetone such as water-based paint (Binggeli, 2014; Hussein, 2012; Sheth, 2016).

Selecting EFIMs is an important element of ESID as it give shape, image, and quality of interior space linking successfully the users with the functional aspects of the space (Alfuraty, 2020). Moreover, material selection form an important stage towards achieving ESID as choosing EFIMs from responsible sources may minimize the embodied energy of the product, minimize consumption of natural raw materials, minimize pollution generation, and toxicity for both the space users and the planet (Hayles, 2015). Thus, the EFIMs life cycle starts with the big demand of ESID in the selecting materials that have the EFIMs characteristics like low embodied energy, recyclable/recycled content, locally sourced, durable, natural/renewable, and no/ low emissions and toxics free materials in order to create effective design solutions and effective disposal options escaping from being accumulated in landfill but transforming it into EFIMs again initiating the closed life cycle for EFIMs (**Figure 4.1**).

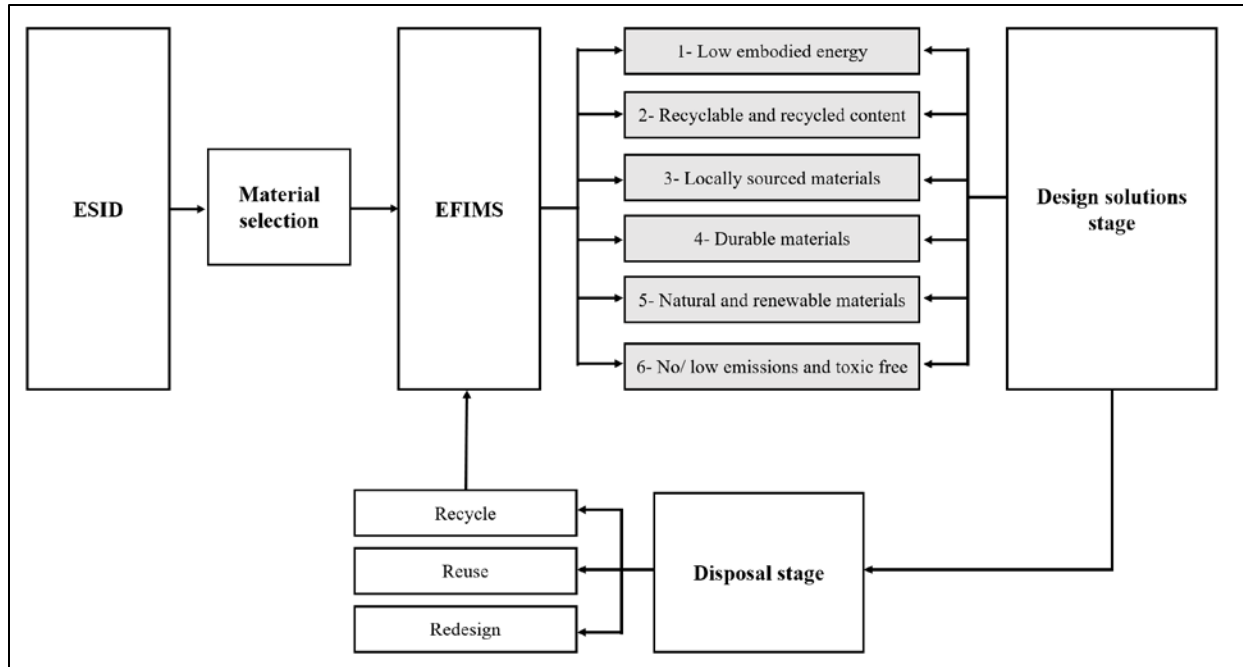


Figure 4.1 Different life cycle stages of EFIMs.

4.2 Observations

Each store among selected (n=30) was observed (not-participant observation) to check the availability of EFIMs and the ease of identifying it from stock as ceiling materials shown in **Figure 4.2**, wall finishing materials in **Figure 4.3** while floor finishing materials are shown in **Figure 4.4**. Few stores have prominently displayed their EFIMs with banners and hanging boards, while in others it was difficult to identify them, especially since some retailers are unsure of what as EFIMs even is. Thus, the researcher had to search herself through volumes of stocked materials looking on tags, taking photographs, and searching online in the manufacturers' webpages for description data. This way of material searching was found time consuming, inefficient, and an obstacle for achieving the environmentally sustainable interior design practices (Hayles, 2015; Kang & Guerin, 2009a; Moussatche, King, & Rogers, 2002). Along similar lines, Altay and Salci (2023) considered the huge range of interior materials currently available in the market as constraints when making meaningful material selection for interior design projects (Altay & Salci, 2023).



Figure 4.2 Photos documenting the observation study for ceiling finishing materials available in Bahrain.

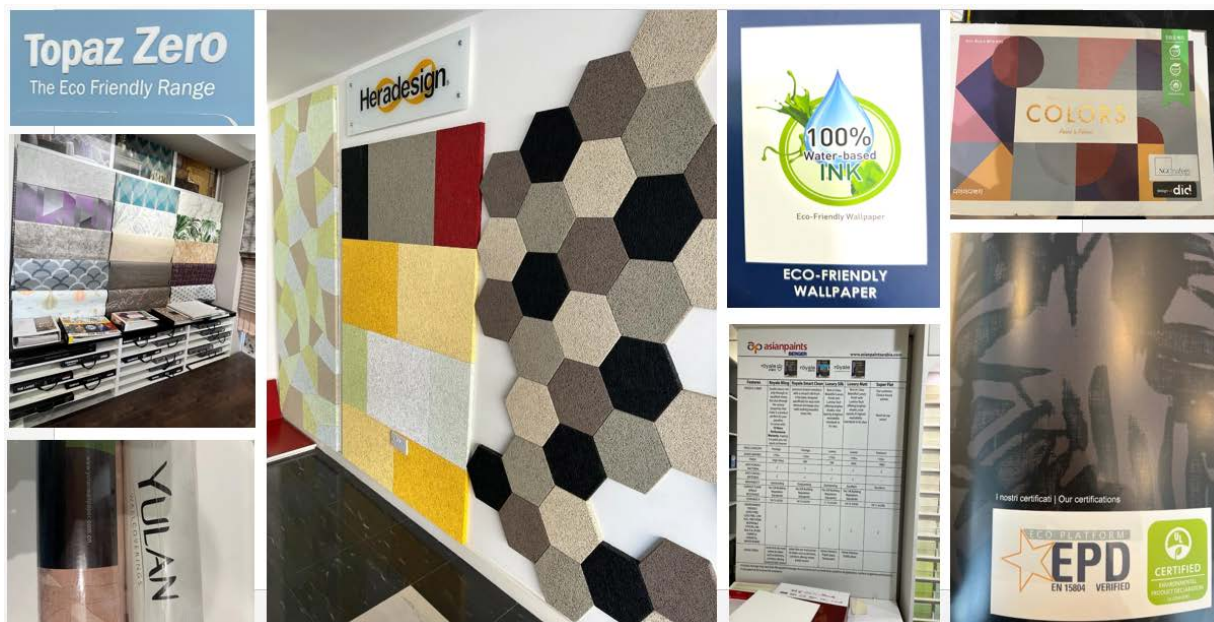


Figure 4.3 Photos documenting the observation study for wall finishing materials present in Bahrain.

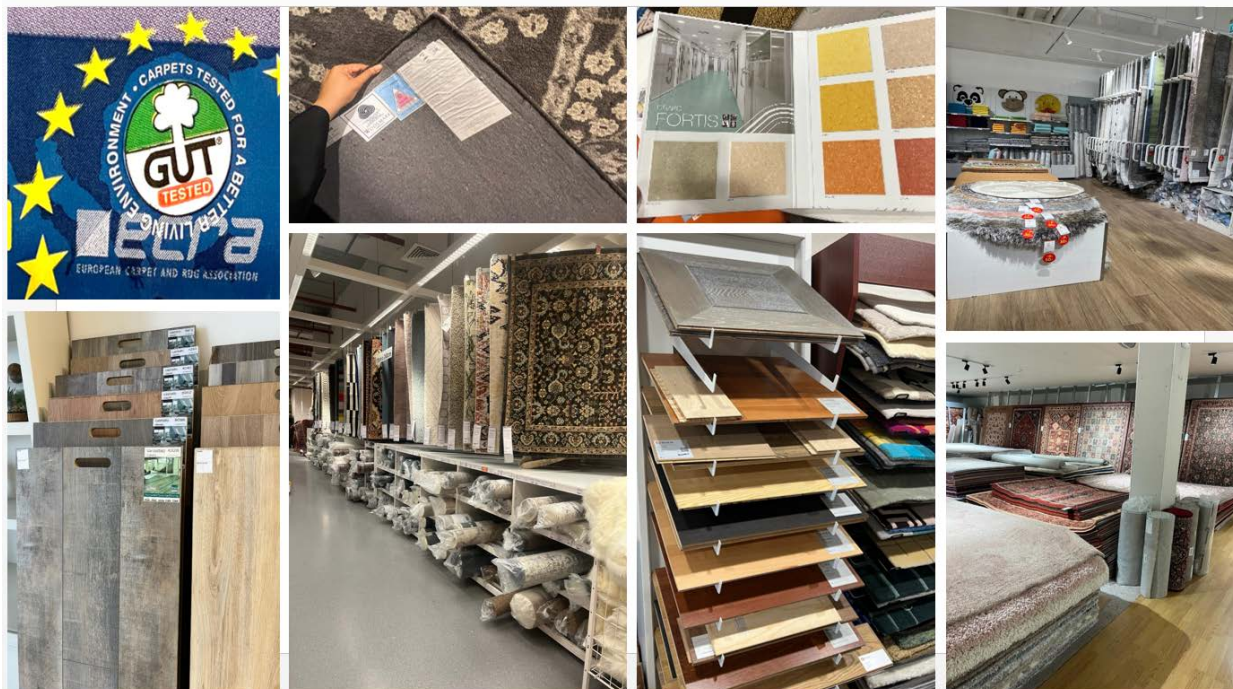


Figure 4.4 Photos documenting the observation study for floor finishing materials available in the local market.

4.3 Survey

Local interior materials suppliers' (n= 30) were surveyed to investigate the availability of EFIMs. Among the selected sample stores, 70% (n=21) of suppliers stocked EFIMs, while 30% (n=9) were supplying conventional interior materials.

4.3.1 EFIMs data found from survey

Examples of EFIMs stocked included the following:

- 1- Wooden laminated floors from sustainably managed forests.
- 2- Low VOCs paints
- 3- Recycled acoustic gypsum tiles.
- 4- Natural fibers floor coverings (rugs)
- 5- Natural materials' wall papers

A total of 63 eco-friendly interior material were collected and identified from the studied stores (n=30). The frequency of EFIMs is shown in **Figure 4.5** as it falls under three categories: ceiling finishing, wall finishing, and floor finishing materials. The floor finishing materials has the biggest frequency 67% (n=42), followed by wall finishing materials 25% (n=16), and finally the ceiling materials 8% (n=5). Comparing these results with findings of Hayles (2015), more walls and ceiling finishing materials were identified in their study than floor finishing materials. Which represent the diversity in supplying these materials according to the market needs.

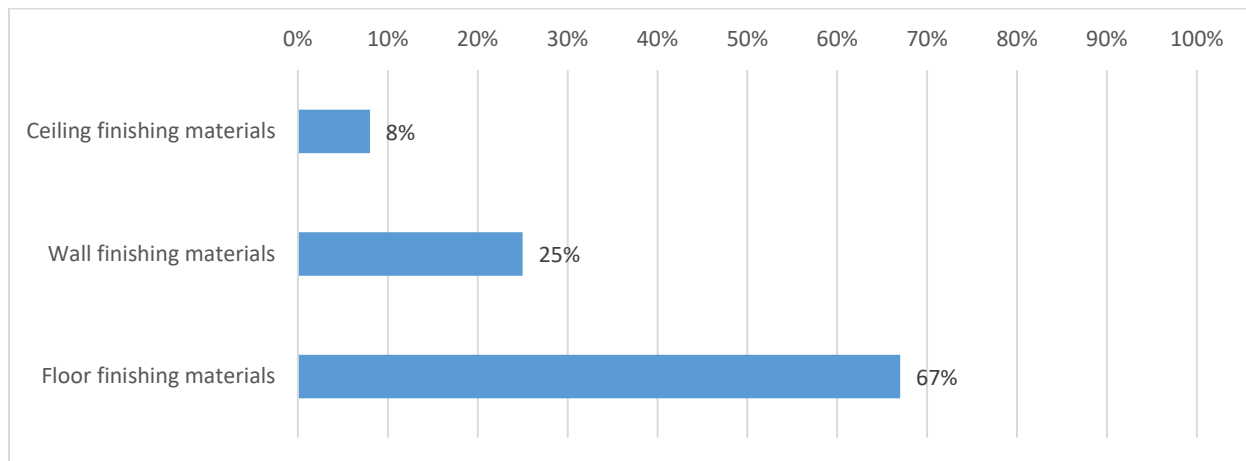


Figure 4.5 Frequency of available EFIMs in Bahrain local market according to their categories.

This primary research tool is inefficient and time consuming as it had to be searched in volumes of stocks of interior materials to determine whether the eco-friendly materials were stocked in local market or otherwise (Hayles, 2015). This method relied the most on three factors; the personal knowledge of the researcher, the manufacturer's specifications and details attached to the products and lastly the existence of the eco-labels attached to the products tags presenting their valuable data related to the environmental impact during life cycle of the product (Hayles, 2015).

The properties of EFIMs where some items may exhibit multiple properties are summarized in **Figure 4.6**.

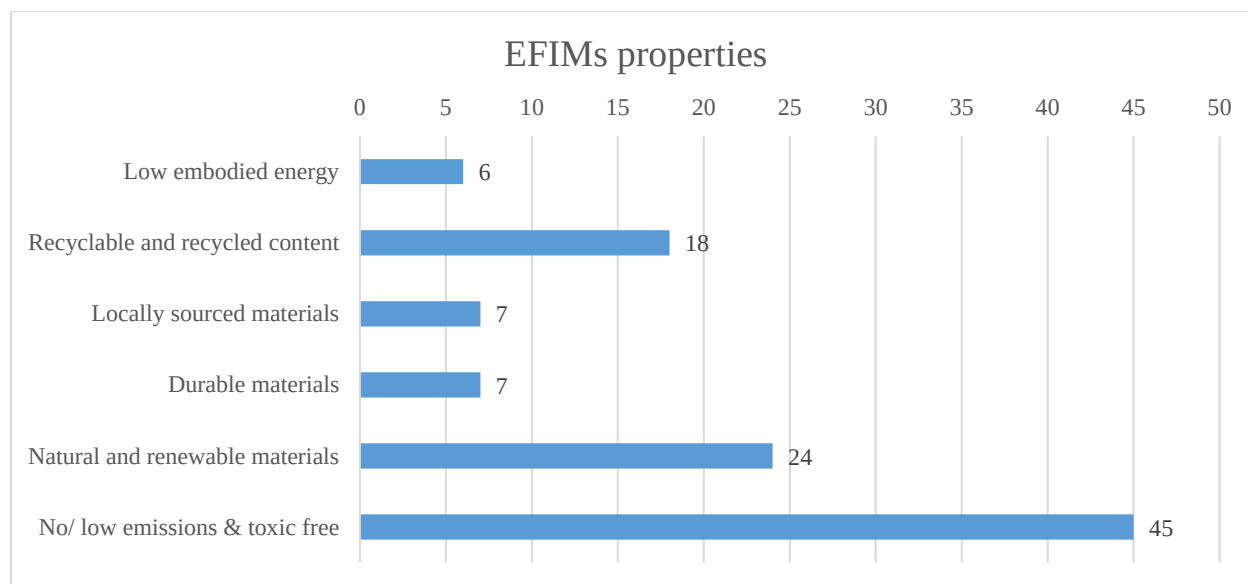


Figure 4.6 Frequency of EFIMs properties found in surveyed interior materials.

These properties are investigated by observation method by reading the tags, searching for eco-labels and other environmental signs, checking products' information on packaging, and searching online in the supplier website for details and specification of these products. The no/low emissions & toxics free property was the most frequently found (45) followed by natural & renewable material property (24). On the other hand, the least property found was low embodied energy (6). This finding reflects the fact that having indoor air free of emissions and toxins is a crucial criterion in the EFIMs available in Bahrain. Thus, contributing effectively to the environmentally friendly interior practices. While other properties are also essential, they may need further focus, legislation, manufacturing guidelines to be incorporated in to their production and encouragement to suppliers to stock EFIMs that have most of these properties. List of EFIMs surveyed in Bahrain markets with its properties, origin, brand, and supplier information are shown in **Table 4.4**.

Table 4.4 List of EFIMs found in Bahrain with its properties, origin, brand, and supplier information.

Surface	Material name	Brand	Origins	Eco label	Properties	Supplier
Ceiling	Gypsum boards	USG BORAL	KSA		• Toxic free • Recycled content. • Durable	Kavalani
	Acoustic gypsum ceiling tiles	Gyproc	France		• Toxic free • Recyclable • Low environmental impacts during the whole life cycle	Kavalani
	Gypsum board and ceiling tiles	United Mining Industries	KSA		• Natural materials • Toxic free • Durable.	Kavalani
	Acoustic ceiling tiles	Knauf AMF	Germany		• Natural materials • Toxic free • 100% recyclable • Low emissions	Alyusuf Decor

	Acoustic ceiling panels	HERADESI GN® wood wool acoustic panels	Germany		• Natural and renewable materials • Toxic free • Recycled or safely disposed. • Durable • Low emissions • Low environmental impacts during the whole life cycle	Alyusuf Decor
Wall	Paint	OMEGA Eco Paint	Bahrain	N/A	• Toxic free • Low emissions	Omega Paints
	Paint	Topaz paints (Hempel)	Denmark	N/A	• Toxic free • Zero VOCs emissions	MANAZEL
	Paint	Royale Atmos Health Shield (Asian Paints Berger)	Bahrain	N/A	• Toxic free • Low emissions	MANAZEL
	Paint	Royale Smart Clean (Asian Paints Berger)	Bahrain	N/A	• Toxic free • Low emissions	MANAZEL
	Paint	Royale Luxury Emulsion	Bahrain	N/A	• Toxic free • Low emissions	MANAZEL

		(Asian Paints Berger)				
	Paint	Fenomastic paints (Jotun)	Dubai		• Toxic free • Low emissions	MANAZEL
	Acoustic wall panels	HERADESI GN® wood wool acoustic panels	Germany	    	• Natural and renewable materials • Toxic free • Recycled or safely disposed • Durable • Low environmental impacts during the whole life cycle	Alyusuf Decor
	Wall panels	GRG wall panels	Bahrain	N/A	• Natural materials • Toxic free • Local sourced material • Recyclable	Alhaiky Factories
		Sangetsu	Japan	N/A	• Low Embodied energy • Natural materials • Toxic free • Durable.	SEDAR
		York Wallcoverings	U.S.A.	N/A	• Natural materials • Toxic free • Low emissions	SEDAR
		JV – 161 ARASHI	Italy	 	• Low VOCs emissions • Toxic free • Natural materials	SEDAR

		Design id (did) - COLORS	Korea		• Low VOCs emissions • Toxic free	SEDAR -Danube Home - KENZ
		Marburg wallcovering	Germany		• Low VOCs emissions • Toxic free	KENZ
		CASA MIA - silver	U.S.A	N/A	Environmentally-friendly wallpaper Washable	KENZ
		YULAN	China		• Recycled material • Low emissions • Locally sourced materials • Toxic free • Durable.	Dream Home Furniture
		SIGNATURE	Korea		Ecofriendly wallpaper - Water-based ink - Global quality base paper	KENZ
Floor	Wooden floor	BOEN Hardwood Floors	Norway		• Natural materials • Very low levels of emissions	Carpets Land
	Vinyl sheet floorcovering	GRABOPLAST	Hungary		• Recyclable • Toxic free	Carpets Land

	Carpet tile	VOXFLOOR	China		• Recyclable • Low environmental impacts during the whole life cycle • Very low levels of emissions	Carpets Land
	Commercial Carpet Tile	Aladdin	U.S.A		• Recycled material • Low emissions	Carpets Land
	Carpet	MOHAWK	U.S.A		• Natural and renewable plant-based material • Low emissions • Recyclable • Toxic free • Durable	Carpets Land
	Commercial Carpet	Belgotex floors	South Africa		• Durable • Low emissions	Carpets Land
	Natural wood floors	Admonter	UK		• Natural and renewable materials • Low environmental impacts during the whole life cycle	Carpets Land
	Laminate floors	Floorpan Classic	Turkey		• Very low levels of emissions • Durable	Dream Home Furniture

	Laminate floors	Krono Original®			• Natural and renewable materials • Low environmental impacts during the whole life cycle • Very low-emission	Magic Interiors
	Laminate floors	AGT Flooring	Turkey		• Very low levels of emissions	Magic Interiors
	Laminate floors	KRONOTE X	Germany		• Natural and renewable materials • Low environmental impacts during the whole life cycle • Very low-emission • Toxic free • Durable	Danube Home
	Carpet	BALATA Arc Edition	Belgium		• Very low-emission • Toxic free • Recycled • Durable	Ashley Home store
		Lano Carpet solutions	Belgium		• Very low-emission • Toxic free • Recycled • Durable	Ashley Home store
	Rugs	NATURA Rug	Belgium		• Toxic free	Ashley Home store

		STAR Rug	Belgium		• Toxic free	Ashley Home store
		RE-FOLD Rug	Belgium	 	• Toxic free • Recycled material	Ashley Home store
		OPUS Rug	Belgium		• Toxic free	Ashley Home store
		TIBET Rug	Belgium		• Toxic free	Ashley Home store
		SFYNX Rug	Belgium		• Toxic free	Ashley Home store
		KASHMAR Rug	Belgium		• Toxic free	Ashley Home store
		LUXURY SHAGGY Rug	Belgium		• Toxic free • Natural materials	Ashley Home store

	Vintage collection Rug	Belgium		• Toxic free • Natural materials	Homes R US
	Touch Rug	Belgium		• Toxic free	Homes R US
	Aiden Chunky Jute Rug	India		• Natural materials • Recyclable	Home center
	ARTEMIS HALI Rug	Turkey		• Toxic free • Natural materials	Dream Home Furniture
	PRATO Exclusive Rug	Turkey		• Toxic free • Natural materials	Rug Land
	Atlantic Rug	Turkey	N/A	• Durable • Natural materials	Rug Land
	Color block Rug	India		• Recycled	West elm

		Taza Easy Care Rug	India		• Very low-emission • Toxic free • Recycled	West elm
		Bonded shag Rug	India		• Natural and renewable plant-based material.	West elm
		Shale striations Rug	India		• Very low-emission • Toxic free • Recycled	West elm
		Jute Boucle Rug	India	N/A	• Natural and renewable plant-based material.	West elm
		Joya shag rug	India		• Natural and renewable animal-based material. • Recycled	West elm
		Chunky twist wool rug	India		• Natural and renewable plant-based material.	West elm
		Remy rug	India		• Natural and renewable animal-based material. • Recycled	West elm
		KALIQ rug	India		• Natural and renewable animal-based material.	The ONE

		Herringbone Rug	India	 	• Natural and renewable animal-based material. • Recycled	Pottery Barn Kids
		Meredith floral Rug	India	 	• Recycled • Toxic free	Pottery Barn Kids
		Concentric square tiles Rug	India		• Recycled	Pottery Barn Kids
		Channing Persian rug	India		• Natural and renewable animal-based material.	Pottery Barn
		Textured recycled thread rug	India		• Recycled	Zara HOME
		TÖRSLEV Rug	Sweden		• Natural and renewable plant-based materials	IKEA

4.3.2 Eco-labels data found from survey

The study examined eco-labels, which are simple logos initiated by several agencies to educate consumers about the environmental impacts of the selected products available in the inventory of local suppliers (Galarraga Gallastegui, 2002; Yokessa & Marette, 2019).

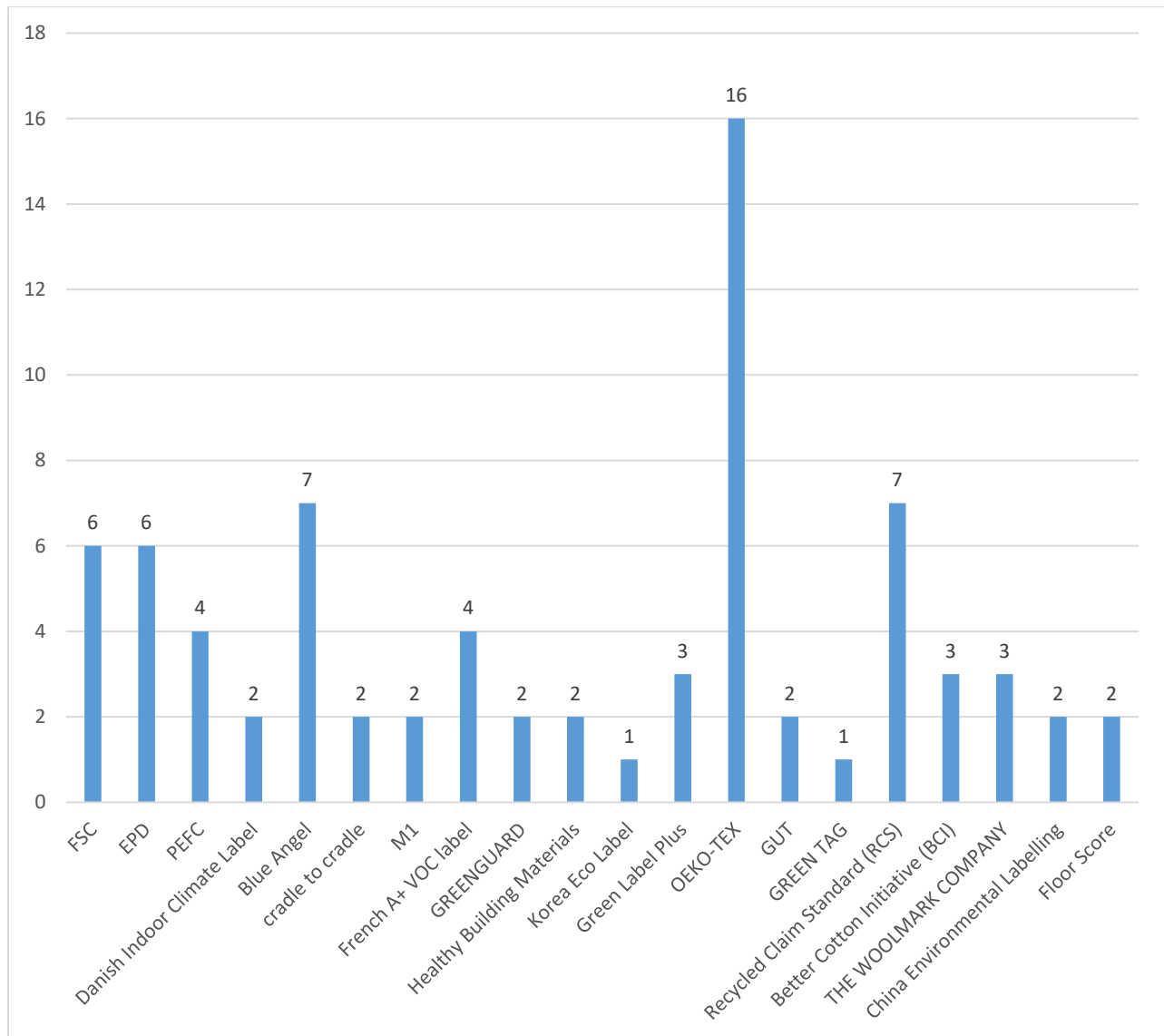


Figure 4.7 Frequency of Eco labels found during surveying EFIMs.

A reasonable number, 20 eco-labels were found during surveying the EFIMs in Bahrain' local market **Figure 4.7**. The most eco-label found is OEKO-TEX 22% (n=16) in floor finishing materials (rugs), followed by Blue Angel 10% (n=7) and Recycled Claim Standard (RCS) 10% (n=7), depicted in **Table 4.5**. Criteria for each eco-label and the category of interior finishing materials related to it are represented in **Table 4.5** (Ecolabelindex, 2024).

Table 4.5 Frequency of Eco-labels found on EFIMs in the market and their criteria.

S. No	Eco-label	Symbol	Criteria	Ceiling	Wall	Floor	Total
1	FSC		Ensure materials sourced from sustainably managed forests.	2	1	3	6
2	EPD		Describing materials in term of their environmental impacts during whole life cycle stages.	3	1	2	6
3	PEFC		Ensure materials sourced from sustainably managed forests.	1	1	2	4
4	Danish Indoor Climate Label		Low VOCs emissions.	1	1	0	2
5	Blue Angel		No harmful substances and low VOCs emissions.	2	1	4	7
6	cradle to cradle		No toxins and the use of recyclable materials. Low or no negative environmental impacts during whole life cycle stages.	1	1	0	2

7	M1		Low VOCs emissions.	1	1	0	2
8	French A+ VOC label		Very Low VOCs emissions.	1	3	0	4
9	GREENGUARD		Low VOCs emissions.	0	2	0	2
10	Healthy Building Materials		Low VOCs emissions	0	2	0	2
11	Korea Eco Label		Toxin free materials.	0	1	0	1
12	Green Label Plus		Very low VOCs emissions.	0	0	3	3
13	OEKO-TEX		No harmful substances.	0	0	16	16
14	GUT		Low VOCs emissions	0	0	2	2
15	GREEN TAG		No toxins and low VOCs emissions.	0	0	1	1
16	Recycled Claim Standard (RCS)		Increase the use of recycled materials products and supply chains.	0	0	7	7
17	Better Cotton Initiative (BCI)		Sustainably sourced cotton	0	0	3	3

18	THE WOOLMARK COMPANY		100% natural and renewable material (wool).	0	0	3	3
19	China Environmental Labelling		The use of renewable and recyclable materials. No toxins and low VOCs emissions.	0	1	1	2
20	Floor Score		Low VOCs emissions	0	0	2	0
Total				12	16	48	75

4.4 Semi structured interviews with retailers

All retailers (n=30) were asked whether they stock EFIMs or not. Most of them, 63% (n=19) mentioned that they did retail EFIMs and were able to present these products' properties and their benefits indoor. Whilst 23% (n= 7) did not retail any EFIMs in their store, 13% (n=4) did retail EFIMs but the respective interviewed salesperson was unaware about it (**Figure 4.8**). In such situations it becomes the responsibility of the researcher to identify the EFIMs retailed in their store and provide them with a brief explanation about its characteristics and indoor benefits. This finding is aligned with Hayles (2015) results, as majority of the interviewed retailers (60%) did stock EFIMs and 30% did not. While, 10% did stock EFIMs but the retailers were unaware of the fact (Hayles, 2015).

When the retailers were asked if customers request EFIMs or not, most retailers 70% (n=21) stated that no customer ever requested EFIMs while 30% (n=9) stated that they were requested to supply EFIMs (**Figure 4.8**). This finding is similar to Hayles (2015), as only 13% of retailers mentioned that they have specifically requested to supply EFIMs. This finding reflects the lack of awareness of the clients worldwide about the benefits of purchasing EFIMs and their reluctance in requesting it (Hayles, 2015).

As per our findings, retailers did not think there is a need for EFIMs in the local market, 37% (n=11) said 'Yes', 50% (n=15) said 'No', and 13% (n=4) said 'Not yet' (**Figure 4.8**). Retailers mentioned that clients do not realize the impact of their selections and they were unaware of its indoor environmental issues such as IAP. Hayles (2015) found similar results as 33% said 'Yes', 17% said 'No', and 20% said "Not yet" confirming that clients were unaware of the consequences of their material selections (Hayles, 2015). That reflects the need to enhance the clients and public awareness about the impacts of their materials selections on their health and the environment as Bettaieb (2019) stated that the health factors were not important criteria in the materials selection such as the off gassing of VOCs (Bettaieb et al., 2019).

Of the 77% (n=23) stores supplying EFIMs, only 37% (n=11) said 'Yes' they do encourage clients to buy EFIMs, while 63% (n=19) said 'No' (**Figure 4.8**) because of the limited information available and the clients have their own preferences when selecting interior materials. Bettaieb (2019) stated that the selection of interior materials is controlled by the clients preferences, aesthetics and budget (Bettaieb et al., 2019). For this reason, many interviewed retailers (63%) in the current study did not encourage clients to purchase EFIMs. This finding aligned with Hayles (2015), when asking a similar question, only 10% replied that they would actively encourage clients to buy EFIMs, which is a small percentage emphasizing the missing role of retailers in marketing EFIMs globally (Hayles, 2015).

Less number of retailers did believe that the health benefits related to EFIMs were widely recognized about 13% (n=4) while most of them, 87% (n=26) did not agree with this fact (**Figure 4.8**). Similar results were found in recent paper as 93% of interviewed retailers didn't believe that health benefits are widely recognized (Hayles, 2015). This result reveals the superficiality of the public awareness about this crucial benefit.

When retailers were asked whether the environmental benefits of using EFIMs were recognized by them, 80% (n=24) said 'No', and 20% (n=6) said 'Yes' (**Figure 4.8**). This result aligned with a literature report, as 83% of interviewed retailers did not believe that the environmental benefits of using EFIMs were widely recognized and only 17% did as a result of participating some educational initiatives that aimed to promote public awareness (Hayles, 2015). To reflect this finding in Bahrain, there is lack of such initiatives to promote the awareness in general public regarding the environmental benefits of applying EFIMs.

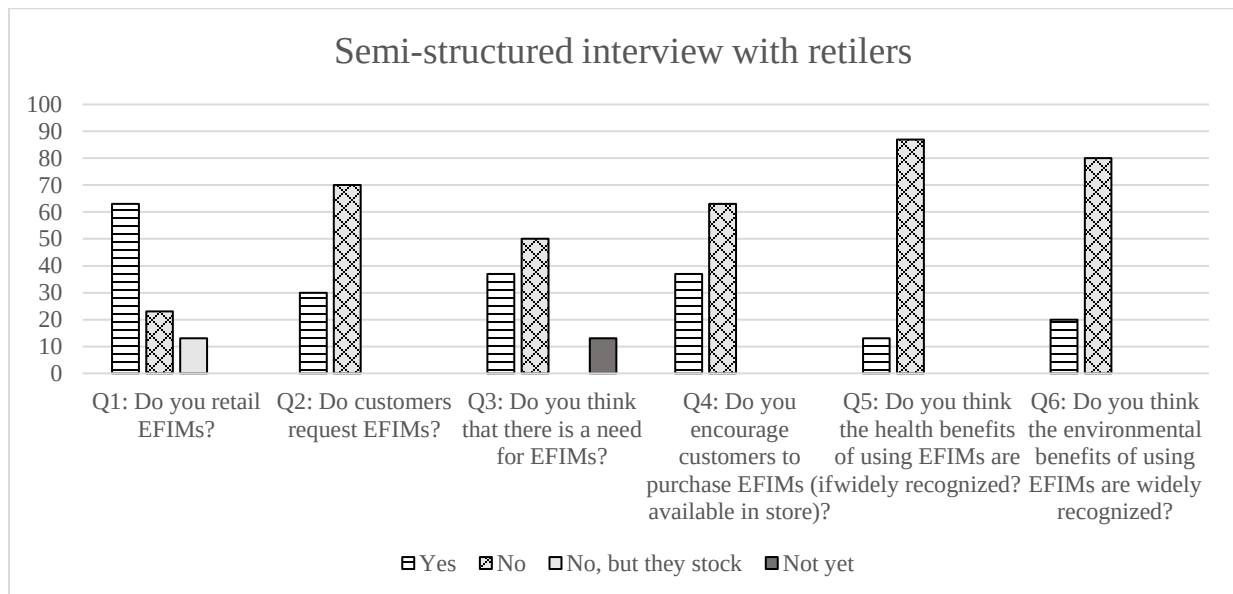


Figure 4.8 Semi structured interviews with retailers.

Lastly, retailers were asked to mention the main barriers that they believe to hinder clients from purchasing EFIMs. In response of this, 53% (n=16) stated that cost is the main barrier that a client faces while buying EFIMs, while 30% (n=9) stated that lack of awareness was a barrier, 10% (n=3) stated that limited materials selection, and only 7% (n=2) stated that limited information about EFIMs is a barrier (**Figure 4.9**).

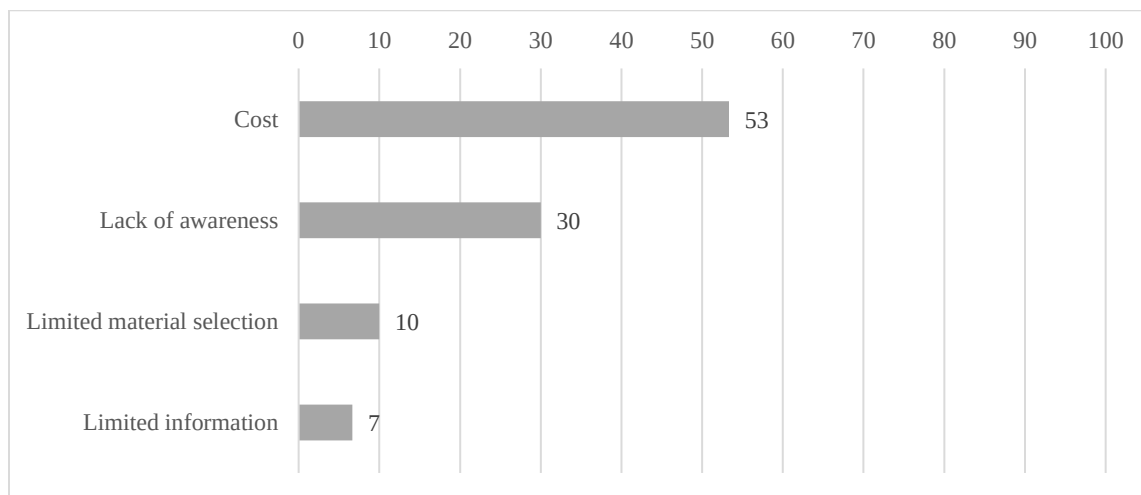


Figure 4.9 Barriers to clients purchasing EFIMs.

Similar barriers were identified in Hayles (2015) when asking retailers about the barriers that the clients faced while purchasing EFIMs (Hayles, 2015). In literature, some researchers addressed several barriers to the selection of EFIMs and to the application of ESID such as perceived cost, limited information of materials, limited options for material selection, accuracy of suppliers, realizing the negative impacts of the materials, and time needed to supply materials (Hankinson & Breytenbach, 2013; Hayles, 2015; Kang & Guerin, 2009b). The current findings are supported by work of Hankinson & Breytenbach (2013) who mentioned three barriers for consumers purchasing EFIMs. First, the accuracy of the information from the product's manufacturers and suppliers. Second, limited EFIMs options to select from a wide range of conventional materials easily available. Third, more relying on imported materials than locally manufactured materials which increase the embodied energy of the material because of transportation and shipping processes (Hankinson & Breytenbach, 2013).

Mate (2009) reported that cost was perceived as the biggest obstacle for only the interior designers who were new in practicing ESIDs, but not for experts qualified interior designers in ESID (Mate, 2009). While Alfuraty (2020), pointed out three barriers in the use of EFIMs. They are, the suppliers' lack of experience and knowledge about these materials, the higher cost in comparison with conventional options and the consumers desires to prioritize the aesthetic value of the material over other environmental issues (Alfuraty, 2020).

4.5 Semi structured interviews with interior designers

Five interior designers from the market were asked five questions related to EFIMs availability in Bahrain and the clients attitude concerning it. They were asked whether EFIMs are available in Bahrain or other wise, 100% (n=5) answered that EFIMs are not widely available with limited quantity and limited varieties. This finding reveals the current case of supplied EFIMs as being limited and not well advertised and poorly marketed to interior designers and clients.

When the interior designers were asked if they use EFIMs in their interior design projects, 80% (n=4) replied negatively, and only 20% (n=1) were positive in answering the questions. This finding emphasizes the fact that EFIMs material information must be clear and readily available to increase the chances in selecting these materials along with the manufacturing specifications

and data sheets especially for busy interior designers to save time and increase their willing to purchase them (Hayles, 2015; Kang & Guerin, 2009a).

The majority of interior designers 80% (n=4) stated that clients did not request EFIMs to be installed in their interior design projects, while only one interior designer 20% (n=1) said 'Yes' but with low number of clients. This finding reflects the current case that the interior designers are driven by the clients' preferences far from EFIMs.

All interior designers interviewed (n=5) did not think that their clients are aware of the importance of EFIMs and their benefits on the health, well-being of dwellers, and the environment.

Lastly, interior designers were asked to mention the main barriers that they believe for clients purchasing EFIMs. Most of them, 80% (n=4) stated that cost is the main barrier that clients face while buying EFIMs, they all were of the opinion 100% (n=5) that limited material selection was a main barrier, 60% (n=3) stated that lack of clients' awareness is a major barrier. Thus, interior designers believe that limited range of material selection is an effective barrier causing reluctance to select EFIMs as the stocked options did not suit their design and the clients preferences, and then cost comes in the second place, and lack of clients' awareness come at the end as a barrier in purchasing EFIMs.

4.6 Phytoremediation experiments

Three indoor ornamental plants were selected to investigate their formaldehyde remediation efficiency as outlined in detail above. Experiments were performed at 5 and 7.5 h intervals, but the results showed unstable graphs and further time was needed to the plant for optimum remediation and obtaining stable graph from the data. Thus, the experiments time was extended to 24 h to test plants purification ability during day and night time. Experiments were conducted for single and double plants during 24 h to collect 2 (initial and final after 24 h) and 24 (after each hour) readings continuously. The HCHO losses from the air-sealed box in the blank experiments due to possible chemical reactions, and absorption by the interior surfaces of the chamber was measured as 13%, which is within the expected range as reported in literature by some authors (Aydogan & Montoya, 2011; K. J. Kim et al., 2008).

4.6.1 The formaldehyde purification rate by a single potted plant (short-term phytoremediation effect)

The formaldehyde purification ability was evaluated during 24 h continuously by logging data at 1 min interval, an average of 60 readings was averaged and 24 readings were therefore tabulated and graphically represented (**Figure 4.10**). During these experiments, the initial formaldehyde concentration was kept at 3 ppm. The three selected plants showed good remediation capacity towards HCHO, in a way that the concentration gradually decreased inside the sealed chamber. By comparing results for all the selected species at the end of experiments, *E. aureum* could absorb HCHO more efficiently than the other two species. The calculated amount of HCHO being remediated by *E. aureum* was found to be 76%, while for the two species *C. comosum* and *S. wallisii* was 69 and 70.5%, respectively.

The formaldehyde purification efficiency by the same species was repeated by collecting initial and final concentrations during 24 h, where the same results were obtained. The measured HCHO purification percentage was found 71.5%, 71%, and 73% for *E. aureum*, *C. comosum*, and *S. wallisii*, respectively (**Table 4.6**).

Table 4.6 The averaged initial concentration C_i , final concentration C_f , and the HCHO purification percentage during 24 h for single potted plant.

	C_i	C_f	HCHO purification %
<i>E. aureum</i>	3.1	0.8	71.5
<i>C. comosum</i>	2.4	0.7	71.0
<i>S. wallisii</i>	2.5	0.7	73.0

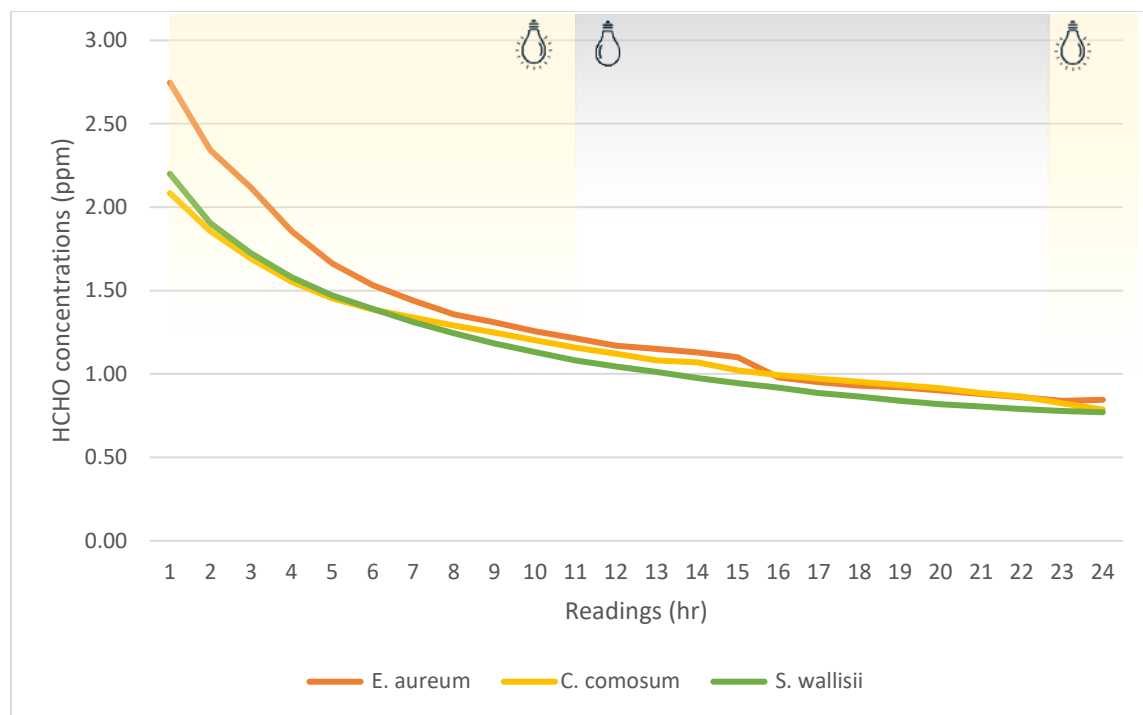


Figure 4.10 HCHO concentration remediated in a gradual way during 24 h, measured continuously for single plant of each indoor potted plant species.

The *S. wallisii* showed better remediation efficiency of 73% towards HCHO in comparison to the other two plants. A possible reason for the better performance of *S. wallisii* could be the size of its leaves, where the absorbance of HCHO is enhanced via stomata and cuticles. The results obtained are consistent with the literature reports (Ghate, 2020) where the same plant was tested for 24 h, in 1 m³ glass chamber; in the presence of HCHO initial concentration of ~5 ppm with 100% removal efficiency. The excellent removal efficiency compared to the present study is due to the addition of the *Sphingomonas* bacteria and activated charcoal to the growing media mixture. Which enhances the role of the rhizosphere in absorbing more HCHO. Results obtained in this study indicate that the plant can remediate the target compound efficiently under normal growing media.

The *C. comosum* and *E. aureum* were both studied in literature (Ghate, 2021) for 24 h and the HCHO concentrations were reduced from 2 to 0 ppm (100% remediation). This reduction was achieved not only by the areal parts of the plants (leaves and stem) but because of the function of

Pseudomonas bacteria and activated charcoal which was added to the growing media mixture. In our study, *E. aureum* under soil system showed lower HCHO reduction percentage (71.5%) than those obtained by Aydogan et al (94%) for the same plant under hydroponic system in 24 h experiment time (Aydogan & Montoya, 2011). The higher removal efficiency is predominantly due to an enhanced growth zone initiated by the water inside the hydroponic growing media (beakers filled with 500 mL distilled water and single drop of plant food); which enable the roots area to progress and stimulate the growth of microbes in the rhizosphere. Previous similar experiments conducted from 2011 till 2022, their results and experimental conditions for single plant present an easy comparison as shown in **Table 4.7**. The *C. comosum* and *E. aureum* were also tested by Xu et al. for HCHO, a purification of about 95, and 84%, respectively was achieved with an inlet concentration range between 1-11 ppm (Zhongjun Xu et al., 2011). It was shown that *C. comosum* had the greatest capacity to remove HCHO from air, compared to other tested plants in the same study. In a similar study removal percentages of HCHO of about 65-100% for *Chamaedorea elegans* for a relatively longer exposure has been reported (Teiri et al., 2018a). Moreover, the same group, reported HCHO removal of about 90-100% for *Nephrolepis obliterate* (Teiri et al., 2018b).

Table 4.7 Similar studies on removal of HCHO from air in a sealed chamber (2011– 2022).

Plants	Experimental conditions			Removal efficiency	Ref.
	Initial conc. (ppm)	Growing media	Chamber volume (m ³)		
<i>E. aureum</i>	~ 2	Hydroponically in 500 mL distilled water and 1 drop of plant food	0.076	94% in 24 h	(Aydogan & Montoya, 2011)
	1-6.5	Dry fluvo-aquic soil	0.075	84% in a long time	(Zhongjun Xu et al., 2011)
	2	Potting mixture with activated charcoal and Pseudomonas chlororaphis liquid culture	1	100% in 24 h	(Ghate, 2021)
	1.4	Potting soil	1	74.4% leaves only in 7.5 h Whole plant ~ 85%	(Zuo et al., 2022)
	15	Potting soil	0.8	99.2% after 7 days	(Zhou et al., 2011)
<i>C. comosum</i>	1-11	Dry fluvo-aquic soil	0.075	95% in a long time	(Zhongjun Xu et al., 2011)
	30, 60, 120	Hydroponically with Hoagland's solution	0.052	135 µg/h/plant	(Su & Liang, 2015)
	2	Potting mixture with activated charcoal and Pseudomonas chlororaphis liquid culture	1	2 ppm reduced to 0ppm in 24 h	(Ghate, 2021)
	15	Potting soil	0.8	100% in 7 days	(Zhou et al., 2011)
<i>N. oblitterata</i>	0.6-11	Potting soil	0.375	90-100% in a long time	(Teiri et al., 2018b)
<i>S. wallisii</i>	5	Potting mixture with activated charcoal injected with	1	100% in 24 h	(Ghate, 2020)

		Sphingomonas consortium			
	15	Potting soil	0.8	99% after 7 days	(Zhou et al., 2011)
<i>C. elegans</i>	0.66-16.4	Potting soil	0.375	65-100% in a long time	(Teiri et al., 2018a)
<i>H. helix</i>	≥ 5	Sterilized media	0.225	Remove 4 ppm over 17.1 h	(Lin, Chen, & Chuah, 2017)
	~ 2	Hydroponically in 500 mL distilled water and 1 drop of plant food	0.076	88% in 24 h	(Aydogan & Montoya, 2011)
<i>Aloe vera</i>	1-8.5	Dry fluvo-aquic soil	0.075	53% in a long time	(Zhongjun Xu et al., 2011)
<i>C. freddie</i>	15	Potting soil	0.8	100% after 7 days	(Zhou, Yue, Chen, & Xu, 2013)
<i>E. aureum</i>	3	BIO-MIX potting soil	1	76 % in 24 h	This study
<i>C. comosum</i>	3	BIO-MIX potting soil	1	69% in 24 h	This study
<i>S. wallisii</i>	3	BIO-MIX potting soil	1	70.5% in 24 h	This study

4.6.2 The purification rate by 2 identical potted plants (short-term phytoremediation effect)

In these experiments, two identical potted plant species each of *E. aureum*, *C. comosum*, and *S. wallisii* were tested under identical experimental conditions as for the single potted plant. Results showed that the *S. wallisii* could purify HCHO the most in comparison to the other plants. The purification percentage was calculated for each plant species where *S. wallisii* was more efficient (84%) followed by *E. aureum* (83%) and least by *C. comosum* (76%) **Figure 4.11**. The results obtained in determining the short-term phytoremediation effect are very close to the previous experiment with slight deviation which is within the expected range as revealed by statistical analysis.

The HCHO removal from the air was also evaluated by collecting initial and final concentration in air inside the box under the same conditions, the collected data are summarized in **Table 4.8**. The measured remediation capacity of plant species was found 77.5%, 73%, and 74.6% for *E. aureum*, *C. comosum*, and *S. wallisii*, respectively. The data being collected follow the same pattern as for single plant species.

Table 4.8 The average initial concentration C_i , final concentration C_f , and the HCHO reduction percentage during 24 h for 2 identical potted plants.

	C_i	C_f	HCHO Reduction %
<i>E. aureum</i>	2.7	0.6	77.5
<i>C. comosum</i>	2.5	0.7	73.0
<i>S. wallisii</i>	2.6	0.7	74.6

In these experiments, results showed the best purification percentage for *E. aureum* followed by *S. wallisii* and the by *C. comosum*. Although *C. comosum* has more long leaves but its efficiency towards air purification is the least. A possible reason might be the nature of the plant that it has sharp and long leaves with no stem as aerial part. Another possible reason is the presence of dense leaves that are covering the surface of the growing media (soil and roots) so the role of underground part might be affected negatively, and remediation is therefore comparatively least among the three species. In case of other two plants as the underground parts are more exposed and being not covered by the plants' leaves.

When applying the ANOVA statistical analysis, the null hypothesis was set as the mean of the three plants are same and there exist no statistical significance. While the alternative hypothesis was set as the mean of the three plants, are not same with a significant difference between them.

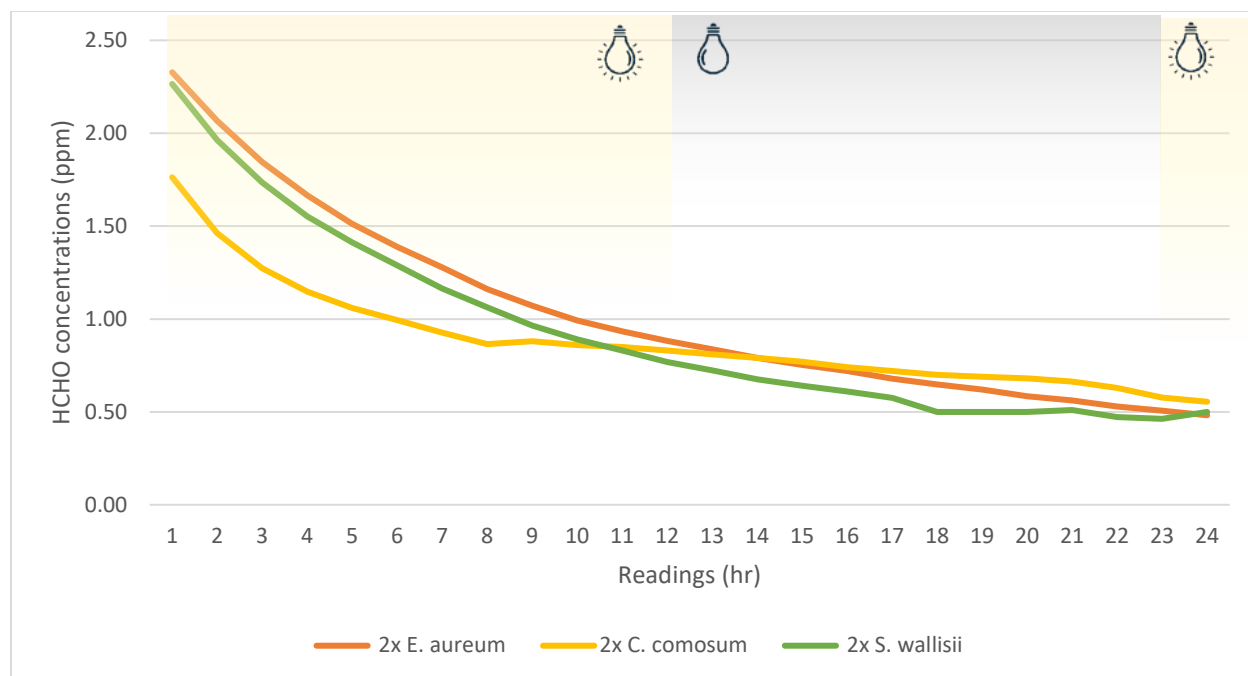


Figure 4.11 Change in HCHO concentrations during 24 h for 2 plants, placed inside the box during the experiment.

4.6.3 Statistically Analyzing HCHO using single plant

An overall decreasing pattern for average HCHO concentration was seen. As F-value is smaller than F crit-value and P-value is more than 0.05, then the null hypothesis cannot be rejected and there is no significant difference between the three plants purification efficiency, **Table 4.9**.

4.6.4 Statistically Analyzing HCHO using 2 identical plants

An overall decreasing pattern for average HCHO concentration was seen. As F-value is smaller than F crit value and P-value is more than 0.05, then the null hypothesis cannot be rejected and there is no significant difference between the three plants purification efficiency, **Table 4.9**.

Thus, the formaldehyde purification efficiency of the three indoor plants (single and 2 identical plants) are similar with a high harnessing potential in remediating indoor formaldehyde.

Table 4.9 ANOVA test of single and 2 identical plants.

ANOVA test of single plants			
<i>Source of Variation</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	0.950	0.392	3.130
ANOVA test of 2 identical plants			
Between Groups	0.663	0.519	3.130

4.6.5 Change in CO₂ levels during experiments

The concentration of CO₂ was measured inside the chamber during the experiments performed in the presence of plant are shown in **Figure 4.12** and the obtained data are summarized in **Table 4.10**. During experiments *E. aureum*, showed the highest CO₂ level inside the box, an increase by 35% for two plants than single plant i.e., 10%. Similarly, for *S. wallisii*, where the CO₂ increase was recorded to be 20% and 9% for two plants and single plant, respectively. For *C. comosum* the increase in CO₂ concentration was inverse, such as 23% for single plant and 2% for two similar plants. Possible reason for rise in CO₂ concentrations in single plant experiments than double plants except *E. aureum* is the high humidity (> 80%) which was generated during the experiment. The *C. comosum* and *S. wallisii* have flattened and bigger leaves where the transpiration rate is high, causing higher relative humidity, approaching 100% at the end of the experiment.

Table 4.10 CO₂ change between single and two identical potted plants during 24 h

	<i>E. aureum</i>	2× <i>E. aureum</i>	<i>C. comosum</i>	2× <i>C. comosum</i>	<i>S. wallisii</i>	2× <i>S. wallisii</i>
1	443.9	555.3	534.2	516.6	562.6	475.1
2	443.3	564.3	539.2	520.5	567.1	488.3
3	439.4	568.4	536.6	514.9	566.3	493.3
4	436.4	573.7	534.7	507.9	564.2	501.8
5	435.6	578.3	534	506.2	563.4	511.1
6	435.1	580.6	532.7	505.4	563.9	517.8
7	434.9	583.8	534.3	507.5	563.4	527.3
8	438.9	586.6	537.6	518.8	563.9	537.6
9	445.1	598.1	540.8	522	563.8	547.2
10	450.2	610.8	547.2	526	565.4	554.7
11	456.7	624.4	558	530	568.5	560.2
12	462.4	640.2	568.7	533	572.8	565
13	468	657.4	578.3	537	576.2	569.3
14	475.5	673.9	581	540	580	572.1
15	489.3	691.4	596.5	544	582.8	575.1
16	497.7	705.5	605	548	585.1	578.8
17	509	718.9	612.8	550	588	580.8
18	517	734	621	555	590.7	573
19	522	746.3	628.7	558	593.3	568
20	506	758.7	636.2	560	596.2	561
21	494.2	759.1	644.8	563.3	598.7	550.3
22	485.4	749.5	647	565	600.4	556.2
23	480.3	742.8	645.2	544.7	599.2	555.2
24	485.6	736.7	642.7	528.2	601.6	551.5
%age	10	35	23	2	9	20

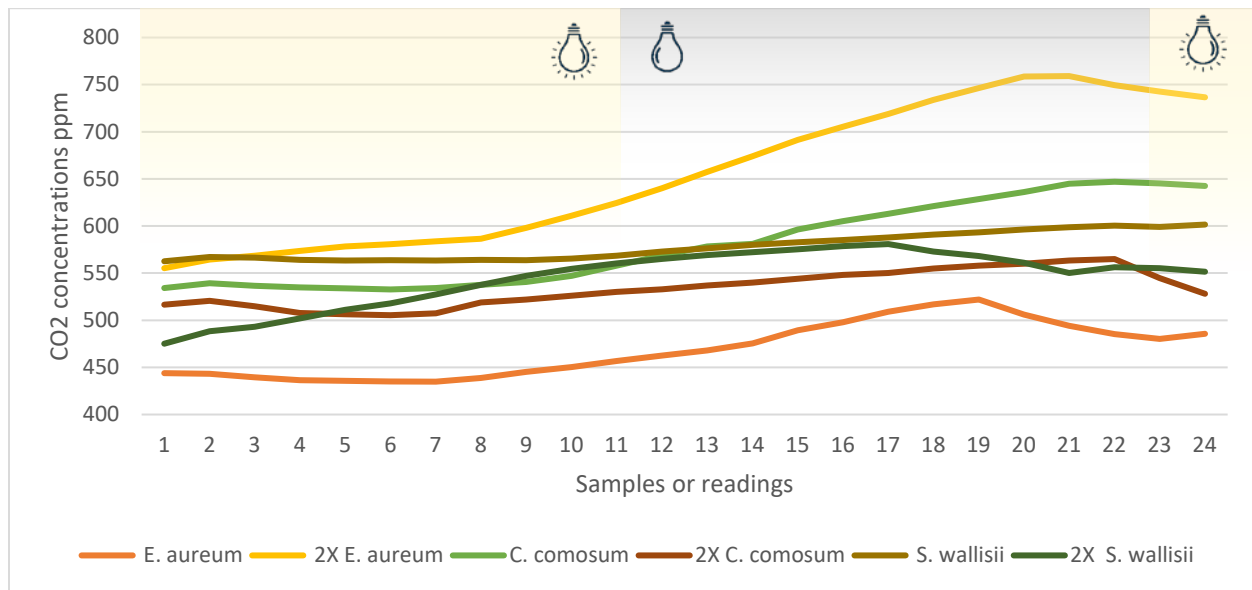


Figure 4.12 Gradual elevation of CO₂ concentration during experiments by single and double potted plants for 24 h. For two identical plants the term “2x” is used, further key for different colors being used is provided within the figure.

When applying the ANOVA statistical analysis to test CO₂, an overall increasing pattern for average CO₂ concentration was seen with the tested indoor potted plants in both cases: single and double plants. The F-value is higher than F crit value and the corresponding P-value is less than 0.05, then the null hypothesis is rejected and there is a significant difference between them,

Table 4. 11.

Table 4. 11 ANOVA test for CO₂ concentrations between all plants as one group (single and double plants cases).

ANOVA test all plants			
Source of Variation	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	54.643	0	2.280

So, the variance value was calculated twice between the single plants group and between the 2 identical plants group to identify the highly significant plant towards CO₂ emission. In the single

plant group, the *C. comosum* has the highest variance value (1965.6) means, it has the highest increase in CO₂ concentration during experiment compared to the other plants, **Table 4.12** and **Figure 4.13**. Similarly, when the CO₂ increase percentage was calculated for these plants, *C. comosum* has increase by 23% as shown in **Table 4.10**. A possible reason for this vast CO₂ increases in concentration is the size of the plant and large number of long dense leaves which lead to high transpiration. While in the two identical plants group, the *E. aureum* has the highest variance value (5546.8) (**Table 4.12**) which means it has the highest increase in CO₂ concentration during experiment as compared to the other plants. Similarly, when the CO₂ percentage was calculated for these plants, it was found that the concentration in case of *E. aureum* has increased by 35% as shown in **Table 4.10**. A possible reason for this vast CO₂ increase concentration is due to the plant species as an evergreen vine with comparatively tall stem which extends to meters long with the greater number of mature leaves may increase the transpiration rate therefore causes CO₂ levels to increase.

Table 4.12 Summary of ANOVA test on CO₂ concentrations using single and double plants (represented by “2x”).

Groups	Count	Sum	Average	Variance
<i>E. aureum</i>	24	11251.9	468.829	841.308
<i>C. comosum</i>	24	13937.2	580.717	1965.556
<i>S. wallisii</i>	24	13824.7	576.029	391.847
2x <i>E. aureum</i>	24	15738.7	655.779	5546.814
2x <i>C. comosum</i>	24	12802	533.417	370.851
2 x <i>S. wallisii</i>	24	13123.5	546.813	925.220

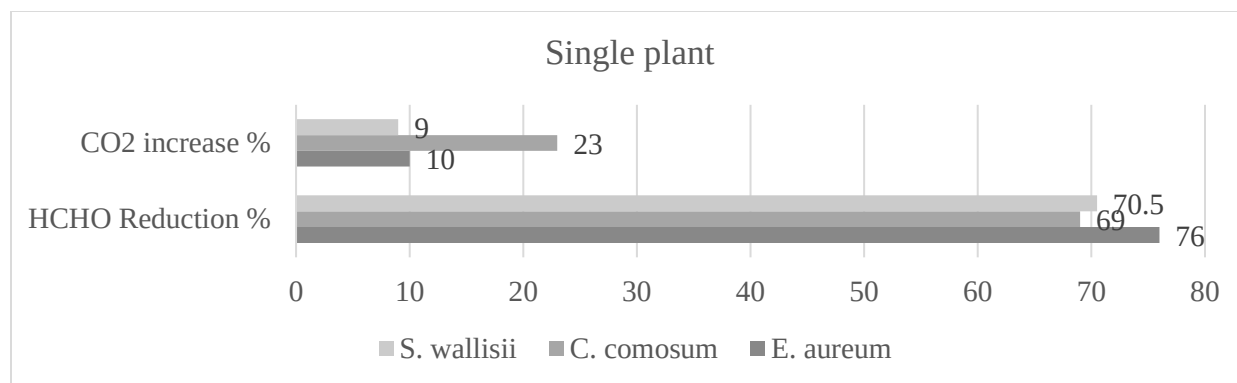


Figure 4.13 Correlation between concentrations of HCHO and CO₂ during single plant experiments.

The current research yields result consistent with the reported studies, demonstrating comparable results. The summarized results in **Figure 4.13** show the correlation between HCHO and CO₂ during single plant experiments. When the HCHO concentration decreases inside the chamber, in contrast the CO₂ concentration increases resulting in an inverse relationship. Zuo et al. postulated that the formaldehyde remediation efficiency of the plant could be clearly reflected by the change in CO₂ concentrations in the expected way (Zuo et al., 2022).

4.6.6 Plants morphology and visible injury

Plant's height is one of the main characteristics of the plant morphology, which was measured before and after the experimental tests to assess the impact of HCHO on its growth. Two additional parameters were considered for each plant:

- 1- Visible injury: The plants were monitored for visible injury after 10 days of exposure where the leaves were inspected for any visible injury or symptoms as compared to the control plant. Nikon digital camera (Nikon DX) was used to take photographs of the leaves of the exposed and the control plants for better comparison and record.
- 2- Pollution Indication Index (PII): It was calculated by counting the number of all the leaves divided by the number of injured leaves multiplied by 100, according to the formula given in Eq. 3, adopted from literature (Ghate, 2020, 2021).

$$PII = \frac{N_E}{N_A} \times 100 \quad \text{Eq. 3}$$

Where, N_E is the number of leaves exposed to HCHO and N_A is the number of affected leaves. After 10 days of conducting the exposure experiments, all plants were carefully inspected for symptoms of any visible injury comparing the exposed set of plant to the control/healthy plant. Furthermore, PII was calculated, the pictures of visible damages of the tested plants' leaves and possible reasons of each damage/symptom are summarized in **Table 4.13**. An overview of literature reports reveal that the damage is not caused by the chemical exposure rather they are due to certain other reasons (Wong, 2006). Brown colored spots on the tips of the leaves of *E. aureum* were developed on both the exposed and control plants. So, they were excluded and not counted as a HCHO exposure visible damage. The *C. comosum* and *S. wallisii* showed brown tips on all leaves of the exposed and the control plants, the effect was neglected and was not counted as a visible injury. The existence of yellow to brown spots on the surface of a few mature leaves of *S. wallisii* called chlorosis were excluded during PII calculations. Such symptoms are owing to the failure of chlorophyll development causing yellowing, bleaching, or fading green leaves into light green, yellow, or white in mature leaves. It happens due to several reasons such as salinity in irrigation water which also cause root damage, or due to the lack of proper nutrition, infection by viruses, insects, and root rot (Adams, Philpot, & Norvell, 1999; Wong, 2006). Thus, these symptoms were excluded and not counted as visible damage due to HCHO exposure and the results of the PII were considered as negligible. A strong tolerance to HCHO exposure inside the air-sealed chamber was shown by the selected plant species. Similar results have been reported in literature for plant species under certain conditions (Ghate, 2020).

The results of the visible injury showed that there is some damage on the leaves but not due to HCHO exposure. Brown tips of all the three tested plants whether they were exposed or control are developed due to the use of tap water irrigation; which probably contains imbalance amount of minerals such as sodium, calcium, magnesium, chlorine, potassium, etc. which are negatively impacting the plants and harming the leaves' cells (Wong, 2006). Peng and colleagues reported some stress responses for indoor plants when exposed to high HCHO levels, it may change the leaves color and change the stomata opening to reduce the formaldehyde uptake by leaves. When plant is placed in HCHO stress environment with elevated range between 5 – 285 ppm, develop brown spots on leaves (Peng et al., 2022).

Tap water analysis of Bahrain has shown an optimum concentration of Na (15.67 ± 4 mg/L) is lower than the EPA standard limits, mainly because of desalination process of sea water (Freije,

Sayeed, & Naser, 2019). Chlorine concentration in tap water, 618.3 mg/L is much higher beyond the EPA maximum residual disinfection level 4 mg/L (EPA, 2023; Musaiger & Khunji, 1990). Possible reason for the visible damage on leaves of *S. wallisii* is explained to be due to extra salinity in irrigation water which causes damage to the roots leading to chlorosis and development of yellow color in mature leaves (Wong, 2006). The *Spathiphyllum* plants grown in indoor environment and in greenhouses could have symptoms of yellowing and wilting of the eldest leaves as a result of root diseases initiated by *C. spathiphylli* on potted plants is already known (Williams-Woodward, 2021). The plants exposed to HCHO were found healthy with continuous normal growth under the provided indoor conditions namely; temperature (<24°C) , humidity(>50%) , light (bright indirect light), and moderate watering (Hessayon, 2001).

Table 4.13 Visible damage of plants' leaves due to reasons other than HCHO exposure.

Plant species	Damage photo of the three plants			Damage	Possible Reasons
	Plant 1	Plant 2	Plant 3 (Control)		
<i>E.aureum</i>				Brown tips	Salinity in irrigation water (tap water).
<i>C. comosum</i>				Brown tips	Salinity in irrigation water (tap water).
<i>S. wallisii</i>				Brown tips and yellow to brown spots in plant 2 only.	Salinity in irrigation water (tap water). Chlorosis.

In the current study, a noticeable increase in the plant height and number of leaves after exposing them to HCHO was observed as shown in **Table 4.14**. The species, *E. aureum* has the highest growth by 59% followed by *S. wallisii* and *C. comosum* 30 and 25%, respectively. Enhanced growth rate of the tested plants revealed that HCHO polluted air up to ~3 ppm could not adversely affect plant growth; which is in line with the literature report (Teiri et al., 2018a). The average height of tested plants in Teiri's study was increased by 6.5% during the fumigation tests. Exposing the plant to various concentrations of HCHO could not terminate the plant's growing habit. An increase in the plant height was calculated as 0.64% during long fumigation experiments (Teiri et al., 2018b). Results obtained in this study are encouraging because the plants are non-native and they tolerate HCHO tense environment, moreover the performance of the plants is very good toward remediation of the same pollutant.

Table 4.14 Height (in cm) of the selected plants measured during the experiments T_0 before test and T_f after 60 days.

Plant	Plant height (cm)		Increase (%)
	T_0	T_f	
<i>E. aureum</i>	22	35	59%
<i>C. comosum</i>	40	50	25%
<i>S. wallisii</i>	27	35	30%

4.7 SWOT analysis of the study

The SWOT analysis (Strengths, Weaknesses, Opportunities, and Threats) is an assessment technique for these four aspects of this study topics. It is an effective tool that helps analyze internal strengths and weaknesses and external opportunities and threats that shape the current situation and help plan successful strategy for future.

Two SWOT analyses were performed, one for the eco-friendly interior materials availability and properties in local market (**Table 4.15**), and the second one for the phytoremediation experiments for indoor potted plants (**Table 4.16**).

The first SWOT analysis (**Table 4.15**) revealed some positive findings such as the availability of EFIMs in some stores and some eco-labels are found attached to the materials' tags certifying its positive environmental impacts. Furthermore, it revealed some negative findings such as the hardness and time consumption while searching for EFIMs. In addition, some barriers were considered as weaknesses such as lack of information, limited material options, the high cost, and the lack of information from some retailers, are all considered as negative points with the absence of guidelines encourage importing EFIMs instead of conventional materials. Some opportunities revealed from this analysis such as to introduce new unified guideline for supplying EFIMs in Bahrain and GCC member states that force suppliers to only opt interior materials with eco-labels otherwise force them to test the imported interior materials in certified testing labs for its environmental performance before shipping. Another opportunity is to increase ESID projects in Bahrain that utilize EFIMs to create healthy and safe indoor environments. Furthermore, create EFIMs database that enables interior designers, architects, and decorators to easily access all EFIMs and access its properties and suppliers' data to utilize it effectively in their daily projects. The last opportunity is to initiate local labs for testing VOCs emissions from imported and locally produced materials. Whiles the threats resulted from this analysis are the spread of sickness, SBS and health issues related to indoor air pollution, and the spread of ambient pollution that destroys our planet earth and its resources.

Table 4.15 SWOT analysis for the EFIMs available in Bahrain market

Strengths	Weaknesses
1- Bahrain's market have a wide range of interior materials in different locations. 2- EFIMs are available in some stores in the local market. 2- Eco-labels are found attached to EFIMs certifying their environmental performance. 3- Few EFIMs have adequate information labeled to it. 4- Retailers are friendly and support research and data collection.	1-Searching EFIMs is hard and time consuming. 2-Lack of material environmental information labelled on some products. 3-Limited options of EFIMs. 4- High cost 5-Absence of guidelines for importing EFIMs. 6-Retailers' lack of awareness and information about the environmental impact of the material.
Opportunities	Threats
1-Introducing new unified guideline for supplying EFIMs in Bahrain and GCC member states that force suppliers to supply interior materials with eco-labels otherwise force them to test the imported interior materials in certified testing labs for its environmental performance before shipping. 2- Increasing ESID projects utilizing EFIMs that create healthy and safe built environments. 3- Creating EFIMs database. 4- Initiating local labs that are equipped with advanced sensors to locally test the VOCs emissions from interior material.	1- Spreading sickness, SBS, and health issues related to IAP. 2- Market will be filled with conventional interior materials. 3- Customers and interior designers continuously requesting and installing conventional materials. 4- Customers cannot afford EFIMs because of expensive quality and their low budget. 5- Depletion of natural resources and spread of pollution, destroying our planet.

Table 4.16 SWOT analysis for the phytoremediation experiments for selected indoor potted plants.

Strengths	Weaknesses
1- A wide range of non-native indoor plants is available in the local market with different volumes and leaf area sizes that positively affect the phytoremediation. 2- Experimental equipment are available and able to conduct experiments inside University laboratories. 3- Plants are powerful natural air cleaners that required less effort, less maintenance, and accepted indoor as decorative elements. 4- Real-time instrument and sensors provide an instant reading that is accurate and help produce better results.	1- No similar experiments conducted locally. 2- Passive system of the potted plant is generally slow in purifying indoor air pollutants. 3- Diverse sources of IAP indoors such as paints, glues, wooden panels, cleaning products, etc. 4- Excessive humidity level inside the fumigation box may damage the sensor and affect the reading.
Opportunities	Threats
1- Attaching the purification efficiency of indoor plants on its information card with other precautionary steps for each indoor plant sold in Bahrain. 2- Test the indoor plants efficiencies during different seasons to have a comprehensive conclusion about its purification efficiencies. 3- Build specific labs to test the indoor plants purification efficiencies. 4- Initiate a database for indoor plants and their efficiencies in cleaning indoor air in different indoor spaces such as: homes, offices, hospitals, and hotels.	1- Spread of sickness, SBS, and health issues related to IAP as airtight buildings increased. 2- Indoor plants are replaced by alternative plastic decorative plants. 3- Depending fully on electronic air purifiers indoor, which are costly and require regular maintenance.

The second SWOT analysis (**Table 4.16**) revealed some positive finding such the availability of wide range of ornamental indoor plants that are non-native in the local market, which is considered as powerful natural air cleaner and attractive decorative element. Another point is the ease of availability of experimental setup, suitable lab, and good quality instruments and sensors that help collect accurate results. Some weaknesses revealed such as the absence of similar experiments conducted locally with the increase of indoor air pollutants sources such as paint, glues and wooden-based decorative elements. Another limitation of phytoremediation is that it is slow process due to the passive system applied using soil system. Moreover, inside the fumigation airtight box the excessive humidity levels may damage the sensor and affect accuracy of the reading. Many opportunities revealed from this analysis such as initiating a database for indoor plants and their efficiencies in cleaning different interior spaces during different seasons to provide a comprehensive summation about each indoor plant to ease its selection process by the clients and interior designers. Another opportunity is to build specific labs to test the purification ability of indoor plants in the passive and active systems such as active green walls. The analysis unveil several threats such as spread of sicknesses, SBS, and other health complications related to IAP. Another concerning aspect is the fully reliance on expensive electronic air purifiers indoor, that required regular maintenance. Additionally, there is a reluctance to place indoor potted plants or replace them with plastic decorative plants.

Chapter 5 Recommendations, future work, public awareness and conclusion

This study assessed two approaches aimed at achieving ESID: examining the availability and properties of EFIMs available in the Bahraini local market and testing the purification efficiencies of specific indoor potted plants toward remediating indoor air pollution.

5.1 EFIMs

The local market of Bahrain was assessed for the availability of the EFIMs because they are considered as a plausible solution in reducing IAP and creating environmentally sustainable interior spaces (ESID). Four connected methods lead to comprehensive findings, namely literature study, observation, survey, and semi-structured interviews. The results from the literature study revealed that EFIMs are interior materials that are used to decorate and finish the interior surface such as ceiling, walls, and floors. The EFIMs are better option than conventional interior materials that have some or all of the following properties low embodied energy, recyclable/recycled content, locally sourced, durable, natural/renewable, and no/low emissions and toxics free materials. While the results from the observation, and survey demonstrate the availability of EFIMs in some stores of the Bahrain's local market with a good environmental performance announced via the eco-labels attached to it. Eco-labels are signs and logos labeled by different agencies and organizational bodies that certify a single or multiple attributes. It accurately tests the material and awards the eco-labels. Which is aimed at encouraging consumers to purchase EFIMs and increase their awareness about the environmental impacts of their selected materials. However, there are many barriers to be considered while purchasing EFIMs such as cost, limited material selection, limited material information, and lack of public awareness. These materials have an increasing demand and are purchased due to many factors such as the awareness and care about the limited natural resources of our planet. In addition, the everyday raising need for healthier, energy efficient and environmentally responsible indoor spaces is also a driving factor.

The SWOT analysis was performed to study the strengths, weaknesses, opportunities, and threats of this study to come up with a workable recommendation, as listed hereunder.

5.2 Recommendations

1. The EFIMs must be continuously designed, produced, and supplied to the market offering a wide range of alternatives for clients and interior designers to select these materials with greater ease and effectively for their projects to meet the environmental and sustainable goals in affordable prices.
2. The EFIMs material information must be clear and readily available to increase the chances in selecting these materials along with the manufacturing specifications and data sheets especially for busy interior designers to save time and increase their willing to purchase it.
3. Create a local and regional database of interior materials that could simplify sourcing EFIMs and knowing about the latest environmental news and trends.
4. Initiate a specific body and framework to encourage continuous development and inspection of products' standards, environmental impacts, and eco-labels.
5. Initiate rules to restrict importing interior materials that do not have eco-labels and environmental signs as tested for environmental performances.
6. Build local labs to test the locally manufactured wooden based interior materials to certify different aspects such as: no/low VOCs emission, no/low HCHO emissions, free of hazardous materials etc.
7. Create educational sessions and awareness enhancement initiatives are recommended for consumers and interior designers about EFIMs and eco-labels explaining the benefits and importance of selecting certified products as environmentally preferable products for the benefits of their health and the environment.
8. Create awareness programs via social media such as: Instagram, online courses, speeches in the radio, programs in TV, group talks/discussions in different centers and associations, YouTube videos, include the knowledge in school and university curriculums, road advertising etc.
9. Interior designers are recommended to:
 - Search about the properties of the selected materials and ask about their raw material, manufacturing processes, transportation method and disposal options before purchasing it.

- Select EFIMs for their clients that have eco-labels certified by authorized organizations by testing them according to specific criteria such as testing for harmful emissions particularly the VOCs.
- Use of low-emitting materials such as the use of water-based paints that have no or low VOCs emissions.
- Use of natural materials from renewable sources and the use of recycled materials extends the material's life span without harming the ecosystem transforming it into a new product.
- Need some new motivation actions to research, specify, and select EFIMs.
- Develop a positive environmental awareness, attitude, and material selection to effectively achieve ESID practices.
- Broaden their knowledge about the consequences of their material selection such as adverse properties and the material interaction with other elements indoor such as emissions under specific temperature and humidity levels.

5.3 Future Work and Research

1. Study the properties of the new and innovative materials that emerge rapidly.
2. Study the availability of EFIMs in the GCC member states such as UAE which have its own IAQ standards and additionally is a huge market.
3. Test local interior materials for VOCs emissions during entire lifespan and make reports thereof.
4. Study the life cycle assessments (LCA) for imported and local interior materials.
5. Investigate the public acceptance and willingness to purchase EFIMs.

5.4 Indoor plants phytoremediation

5.5 Limitations

High relative humidity accumulated inside the air-sealed box during experiments could affect the accuracy of the sensors in measuring the concentrations of HCHO and CO₂. Many times, the sensors showed warning message of exceeding the maximum humidity level of 75% and this could destroy the sensor or affect its accuracy.

Silica gel 100 g, in a glass plate was kept inside the box to absorb extra humidity and maintain the optimum level as per the manufacturer recommendations. However, it reduced the initial concentration of HCHO inside the box which negatively affected results and it was not possible to precisely measure the remediation efficiency of the plant. Furthermore, after 24 h, the humidity percentage inside the air-sealed box exceeded the recommended limit as was observed without adding the silica gel. It clearly revealed that silica gel has an effect initially while afterwards it becomes saturated and cannot control the excess humidity. Further, increasing the humidity amount could lead to erroneous results and cannot be recommended to keep it at its higher side inside the box. Some studies in controlled environment in the presence of a dehumidifier are required to eliminate the effect of excess humidity on the remediation capacity and exact concentration of CO₂.

5.6 Recommendations

- 1- The same plant species are recommended to be screened under the same conditions for long time in real environments.
- 2- Before applying any plant species for the purpose of experiment, other factors must be considered such as water quality and growing media etc. as it is recommended to use treated water to avoid salinity and to use good growing mix soil.
- 3- In addition, it is recommended to select a lab for experimenting that can fully control these environmental factors such as light, temperature, and humidity level as it has a separate air conditioning unit to imitate real situations and different temperature and humidity levels similar to different seasons in interior conditions.

5.7 Future Work and Research

Certainly, search needs to be continue and supported in the field of phytoremediation of indoor ornamental plants. In view of the findings of the current study, the following research topics are suggested:

- 1- Test other available indoor potted plants species that are non-native and available in the local market to understand their purification effectiveness toward cleaning indoor air.
- 2- Test the same indoor potted plants but with different growing media (hydroponic system) and compare their purification abilities.

- 3- Investigate the accurate volume and number of indoor plants to effectively remediate indoor air pollutants for healthy built environments under the real local environmental conditions.
- 4- Compare purification efficiencies between indoor plants and electronic air purifiers in lab conditions and in real environments.
- 5- Perform similar experiments in real environments such as homes, offices, and classrooms.
- 6- Testing the efficiency of plants of this study and other ornamental plants for their efficiency in purifying other indoor air pollutants such as benzene and toluene etc. This will generate a better understanding and optimum attitude when choosing indoor plants.
- 7- Test the chlorophyll content as an experimental method to evaluate the removal rate of the indoor air pollutant.

5.8 Conclusion

Purification of formaldehyde polluted air was carried out by non-native indoor potted plants namely, *Epipremnum aureum* (Pothos plant), *Chlorophytum comosum* (Spider plant), and *Spathiphyllum wallisii* (Peace lily), inside a sealed fumigation box. Each plant was exposed to polluted air with approximately 3 ppm HCHO for 24 h and remediation efficiency was determined. Normal growth medium was applied which was considered to contribute negligibly, in comparison to the aerial parts of the plant. Among the three species, the most efficient was *E. aureum* with 76% HCHO remediation efficiency, followed by *S. wallisii* and *C. comosum* with 70.5 and 69%, respectively. Increasing the number of plants for the same concentration followed the same order for the selected species in a relatively shorter time. The concentration of CO₂ inside the box increased due to decomposition of HCHO by plant which was also measured as governing factor of efficiency. From statistical analysis, there is no significant difference ($P > 0.05$) in the HCHO purification efficiency between the three tested indoor plants (single and double plant cases) as they all are almost equally effective. However, in the case of setting single plant, *C. comosum* is the highest in emitting CO₂; while in case of two identical plants together, *E. aureum* emits the most CO₂ because of HCHO metabolism inside the plant. The three tested plant species are similar with a high harnessing potential in remediating indoor HCHO. It can tolerate polluted air saturated with HCHO without or negligible effect on their normal growth thus they are recommended to be utilized indoor for HCHO phytoremediation in polluted closed environments.

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Appendix A

Preliminary indoor air quality testing were conducted to measure the concentrations of TVOCs, CO₂, formaldehyde, and ozone in two indoor zones. Unexpectedly, the results showed no evidence of high concentrations beyond the acceptable range and all readings were within the limits as shown in **Table S1** below.

Air pollutant	Mean of short time exposure		Acceptable limits
	Indoor space A	Indoor space B	
TVOC	0.12 ppm	0.07 ppm	<0.3 ppm
HCHO	0.02 ppm	0.02 ppm	0.1 ppm
CO ₂	483 ppm	362 ppm	<500 ppm
CO	0.9 ppm	0.95 ppm	0.5 – 5 ppm
Ozone	0.03 ppm	0.07 ppm	<0.1 ppm

Data collected during 24 hours for the two indoor environments (A) and (B) are displayed in **Table S2** and **Table S3** respectively.

Table S2: Concentrations of Indoor air pollutants in indoor space A during 24 hr.

Date Time	TVOC ppm	Carbon Dioxide ppm	Ozone ppm	Carbon Monoxide ppm	Temperature °C	Relative Humidity %RH
20-Jun-21 12:11:06 PM	0.14	601	0.05	1.0	25.9	45.0
20-Jun-21 12:12:07 PM	0.14	703	0.06	0.9	26.4	47.6
20-Jun-21 12:13:08 PM	0.14	634	0.03	0.8	26.7	46.7
20-Jun-21 12:14:09 PM	0.14	603	0.03	1.0	27.0	44.5
20-Jun-21 12:15:10 PM	0.14	584	0.02	1.1	27.0	43.5
20-Jun-21 12:16:11 PM	0.14	583	0.02	1.2	26.9	43.4
20-Jun-21 12:17:12 PM	0.14	582	0.02	1.2	27.2	43.1
20-Jun-21 12:18:13 PM	0.13	580	0.02	1.2	27.2	42.9
20-Jun-21 12:19:14 PM	0.13	575	0.02	1.2	27.2	42.7
20-Jun-21 12:20:15 PM	0.13	583	0.03	1.2	27.2	42.9
20-Jun-21 12:21:16 PM	0.13	582	0.02	1.2	27.1	42.9
20-Jun-21 12:22:17 PM	0.13	580	0.02	1.2	27.2	42.8
20-Jun-21 12:23:18 PM	0.13	582	0.03	1.2	27.2	42.8
20-Jun-21 12:24:19 PM	0.13	581	0.02	1.2	27.3	42.5
20-Jun-21 12:25:20 PM	0.13	587	0.02	1.2	27.4	42.7
20-Jun-21 12:26:21 PM	0.13	579	0.02	1.2	27.4	42.5
20-Jun-21 12:27:22 PM	0.13	580	0.02	1.2	27.5	42.4
20-Jun-21 12:28:23 PM	0.13	588	0.02	1.2	27.4	42.7
20-Jun-21 12:29:24 PM	0.13	596	0.03	1.2	27.4	42.9
20-Jun-21 12:30:25 PM	0.13	593	0.02	1.2	27.4	42.7
20-Jun-21 12:31:26 PM	0.13	593	0.03	1.2	27.3	42.8
20-Jun-21 12:32:27 PM	0.13	596	0.03	1.2	27.3	43.3
20-Jun-21 12:33:28 PM	0.13	599	0.03	1.2	27.2	43.3
20-Jun-21 12:34:29 PM	0.13	592	0.02	1.2	27.3	43.2
20-Jun-21 12:35:30 PM	0.13	589	0.02	1.2	27.1	43.1
20-Jun-21 12:36:31 PM	0.13	589	0.03	1.1	27.1	43.4
20-Jun-21 12:37:32 PM	0.13	581	0.02	1.1	27.1	43.4
20-Jun-21 12:38:33 PM	0.13	570	0.03	1.1	27.0	43.0
20-Jun-21 12:39:34 PM	0.13	580	0.03	1.1	26.9	43.3
20-Jun-21 12:40:35 PM	0.13	594	0.03	1.1	27.2	43.4
20-Jun-21 12:41:36 PM	0.13	598	0.03	1.1	27.1	43.3
20-Jun-21 12:42:37 PM	0.13	592	0.03	1.0	26.9	43.6
20-Jun-21 12:43:38 PM	0.13	583	0.02	1.1	26.9	43.4
20-Jun-21 12:44:39 PM	0.13	573	0.03	1.1	26.9	43.3
20-Jun-21 12:45:40 PM	0.13	582	0.03	1.0	26.9	43.4
20-Jun-21 12:46:41 PM	0.13	585	0.02	1.0	27.0	43.3
20-Jun-21 12:47:42 PM	0.13	588	0.02	1.0	27.1	43.2
20-Jun-21 12:48:43 PM	0.13	587	0.02	1.0	27.1	43.0
20-Jun-21 12:49:44 PM	0.13	594	0.03	1.0	26.9	43.5
20-Jun-21 12:50:45 PM	0.13	584	0.02	1.0	27.1	43.4
20-Jun-21 12:51:46 PM	0.12	578	0.02	1.0	27.2	43.2
20-Jun-21 12:52:47 PM	0.12	571	0.02	1.0	27.2	43.2
20-Jun-21 12:53:48 PM	0.12	570	0.02	1.1	27.2	43.1
20-Jun-21 12:54:49 PM	0.13	562	0.02	1.1	27.1	43.2
20-Jun-21 12:55:50 PM	0.12	558	0.02	1.1	27.2	43.1
20-Jun-21 12:56:51 PM	0.12	552	0.03	1.1	27.1	43.2
20-Jun-21 12:57:52 PM	0.13	550	0.03	1.1	27.1	43.3
20-Jun-21 12:58:53 PM	0.12	548	0.02	1.1	27.1	43.2
20-Jun-21 12:59:54 PM	0.12	544	0.03	1.1	27.0	43.1
20-Jun-21 01:00:55 PM	0.12	544	0.03	1.1	27.0	43.3
20-Jun-21 01:01:56 PM	0.12	545	0.03	1.1	26.9	43.3
20-Jun-21 01:02:57 PM	0.12	541	0.03	1.0	26.8	43.4
20-Jun-21 01:03:58 PM	0.12	542	0.03	1.0	26.8	43.5
20-Jun-21 01:04:59 PM	0.12	541	0.03	1.0	26.8	43.5
20-Jun-21 01:06:00 PM	0.12	538	0.03	1.0	26.7	43.5
20-Jun-21 01:07:01 PM	0.12	536	0.03	1.0	26.8	43.6

20-Jun-21 01:08:02 PM	0.12	537	0.03	1.0	26.7	43.6
20-Jun-21 01:09:03 PM	0.12	540	0.03	1.0	26.7	43.6
20-Jun-21 01:10:04 PM	0.12	536	0.03	1.0	26.7	43.6
20-Jun-21 01:11:05 PM	0.12	537	0.03	1.0	26.8	43.7
20-Jun-21 01:12:06 PM	0.12	538	0.03	1.0	26.9	43.7
20-Jun-21 01:13:07 PM	0.12	538	0.03	1.0	26.8	43.7
20-Jun-21 01:14:08 PM	0.12	537	0.03	1.0	26.8	43.7
20-Jun-21 01:15:09 PM	0.12	534	0.03	1.0	26.8	43.7
20-Jun-21 01:16:10 PM	0.12	534	0.03	1.0	26.8	43.7
20-Jun-21 01:17:11 PM	0.12	534	0.03	1.0	26.7	43.7
20-Jun-21 01:18:12 PM	0.12	535	0.03	1.0	26.7	43.7
20-Jun-21 01:19:13 PM	0.12	537	0.03	1.0	26.8	43.8
20-Jun-21 01:20:14 PM	0.12	535	0.03	1.0	26.8	43.8
20-Jun-21 01:21:15 PM	0.12	535	0.03	1.0	26.8	43.8
20-Jun-21 01:22:16 PM	0.12	532	0.03	1.0	26.8	43.8
20-Jun-21 01:23:17 PM	0.12	538	0.03	1.0	26.7	43.8
20-Jun-21 01:24:18 PM	0.12	537	0.03	1.0	26.7	43.7
20-Jun-21 01:25:19 PM	0.12	537	0.03	1.0	26.8	43.7
20-Jun-21 01:26:20 PM	0.12	535	0.03	1.0	26.6	43.7
20-Jun-21 01:27:21 PM	0.12	535	0.03	1.0	26.7	43.7
20-Jun-21 01:28:22 PM	0.12	538	0.03	1.0	26.7	43.7
20-Jun-21 01:29:23 PM	0.12	537	0.03	1.0	26.7	43.7
20-Jun-21 01:30:24 PM	0.12	535	0.03	1.0	26.6	43.7
20-Jun-21 01:31:25 PM	0.12	537	0.03	1.0	26.6	43.7
20-Jun-21 01:32:26 PM	0.12	535	0.03	1.0	26.7	43.7
20-Jun-21 01:33:27 PM	0.12	533	0.03	1.0	26.6	43.7
20-Jun-21 01:34:28 PM	0.12	533	0.03	1.0	26.6	43.6
20-Jun-21 01:35:29 PM	0.12	532	0.03	1.0	26.7	43.7
20-Jun-21 01:36:30 PM	0.12	531	0.03	1.0	26.7	43.7
20-Jun-21 01:37:31 PM	0.12	533	0.03	1.0	26.6	43.6
20-Jun-21 01:38:32 PM	0.12	535	0.03	1.0	26.6	43.6
20-Jun-21 01:39:33 PM	0.12	536	0.03	1.0	26.6	43.7
20-Jun-21 01:40:34 PM	0.12	537	0.03	1.0	26.6	43.7
20-Jun-21 01:41:35 PM	0.12	534	0.03	1.0	26.6	43.6
20-Jun-21 01:42:36 PM	0.12	531	0.03	1.0	26.7	43.7
20-Jun-21 01:43:37 PM	0.12	532	0.03	1.0	26.6	43.7
20-Jun-21 01:44:38 PM	0.12	537	0.03	1.0	26.7	43.7
20-Jun-21 01:45:39 PM	0.12	535	0.03	1.0	26.7	43.7
20-Jun-21 01:46:40 PM	0.12	535	0.03	1.0	26.8	43.6
20-Jun-21 01:47:41 PM	0.12	535	0.03	1.0	26.7	43.6
20-Jun-21 01:48:42 PM	0.12	534	0.03	1.0	26.7	43.5
20-Jun-21 01:49:43 PM	0.12	533	0.03	1.0	26.6	43.5
20-Jun-21 01:50:44 PM	0.12	536	0.03	1.0	26.7	43.5
20-Jun-21 01:51:45 PM	0.12	535	0.03	1.1	26.7	43.4
20-Jun-21 01:52:46 PM	0.12	550	0.03	1.1	26.6	43.4
20-Jun-21 01:53:47 PM	0.12	549	0.03	1.1	26.6	43.5
20-Jun-21 01:54:48 PM	0.12	545	0.03	1.0	26.7	43.5
20-Jun-21 01:55:49 PM	0.12	545	0.03	1.0	26.8	43.5
20-Jun-21 01:56:50 PM	0.12	540	0.03	1.0	26.7	43.5
20-Jun-21 01:57:51 PM	0.12	538	0.03	1.0	26.7	43.4
20-Jun-21 01:58:52 PM	0.12	538	0.03	1.0	26.8	43.4
20-Jun-21 01:59:53 PM	0.12	535	0.03	1.0	26.7	43.4
20-Jun-21 02:00:54 PM	0.12	534	0.03	1.0	26.8	43.3
20-Jun-21 02:01:55 PM	0.12	536	0.03	1.0	26.8	43.3
20-Jun-21 02:02:56 PM	0.12	535	0.03	1.0	26.7	43.2
20-Jun-21 02:03:57 PM	0.12	532	0.03	1.0	26.8	43.2
20-Jun-21 02:04:58 PM	0.12	531	0.03	1.0	26.7	43.1

20-Jun-21 02:05:59 PM	0.12	529	0.03	1.0	26.7	43.1
20-Jun-21 02:07:00 PM	0.12	533	0.03	1.0	26.6	43.1
20-Jun-21 02:08:01 PM	0.12	531	0.03	1.0	26.6	43.1
20-Jun-21 02:09:02 PM	0.12	529	0.03	1.0	26.6	43.1
20-Jun-21 02:10:03 PM	0.12	532	0.03	1.0	26.6	43.1
20-Jun-21 02:11:04 PM	0.12	530	0.03	1.0	26.6	43.1
20-Jun-21 02:12:05 PM	0.12	544	0.03	1.0	26.6	43.2
20-Jun-21 02:13:06 PM	0.12	561	0.03	1.0	26.7	43.2
20-Jun-21 02:14:07 PM	0.12	554	0.02	1.0	26.7	43.3
20-Jun-21 02:15:08 PM	0.12	549	0.03	1.0	26.7	43.2
20-Jun-21 02:16:09 PM	0.12	546	0.03	1.0	26.6	43.2
20-Jun-21 02:17:10 PM	0.12	545	0.03	1.0	26.7	43.2
20-Jun-21 02:18:11 PM	0.12	542	0.03	1.0	26.6	43.1
20-Jun-21 02:19:12 PM	0.12	542	0.03	1.0	26.7	43.1
20-Jun-21 02:20:13 PM	0.12	547	0.02	1.0	26.9	43.2
20-Jun-21 02:21:14 PM	0.12	548	0.02	1.0	27.0	43.2
20-Jun-21 02:22:15 PM	0.12	547	0.02	1.0	26.9	43.0
20-Jun-21 02:23:16 PM	0.12	553	0.02	1.0	27.1	43.0
20-Jun-21 02:24:17 PM	0.12	550	0.02	1.0	27.0	42.9
20-Jun-21 02:25:18 PM	0.12	550	0.02	1.1	27.0	42.8
20-Jun-21 02:26:19 PM	0.12	547	0.02	1.1	27.1	42.7
20-Jun-21 02:27:20 PM	0.12	550	0.02	1.0	27.1	42.7
20-Jun-21 02:28:21 PM	0.12	543	0.02	1.0	27.2	42.6
20-Jun-21 02:29:22 PM	0.12	546	0.02	1.0	27.1	42.5
20-Jun-21 02:30:23 PM	0.12	548	0.02	1.0	27.2	42.6
20-Jun-21 02:31:24 PM	0.12	546	0.02	1.1	27.2	42.6
20-Jun-21 02:32:25 PM	0.12	546	0.02	1.0	27.2	42.5
20-Jun-21 02:33:26 PM	0.12	545	0.02	1.1	27.2	42.5
20-Jun-21 02:34:27 PM	0.12	547	0.02	1.1	27.3	42.5
20-Jun-21 02:35:28 PM	0.12	544	0.02	1.1	27.3	42.4
20-Jun-21 02:36:29 PM	0.12	546	0.02	1.1	27.4	42.3
20-Jun-21 02:37:30 PM	0.12	546	0.02	1.1	27.4	42.3
20-Jun-21 02:38:31 PM	0.12	546	0.02	1.1	27.4	42.3
20-Jun-21 02:39:32 PM	0.12	540	0.02	1.2	27.4	42.1
20-Jun-21 02:40:33 PM	0.12	538	0.02	1.2	27.4	42.0
20-Jun-21 02:41:34 PM	0.12	535	0.02	1.2	27.3	41.9
20-Jun-21 02:42:35 PM	0.12	541	0.02	1.2	27.4	41.9
20-Jun-21 02:43:36 PM	0.12	542	0.02	1.1	27.5	41.9
20-Jun-21 02:44:37 PM	0.12	541	0.02	1.1	27.4	41.8
20-Jun-21 02:45:38 PM	0.12	541	0.02	1.1	27.3	41.8
20-Jun-21 02:46:39 PM	0.12	539	0.02	1.1	27.5	41.8
20-Jun-21 02:47:40 PM	0.12	539	0.02	1.1	27.5	41.8
20-Jun-21 02:48:41 PM	0.12	535	0.02	1.1	27.3	41.6
20-Jun-21 02:49:42 PM	0.12	532	0.02	1.1	27.3	41.5
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20-Jun-21 02:51:44 PM	0.12	547	0.02	1.1	27.4	41.6
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20-Jun-21 02:53:46 PM	0.12	538	0.02	1.1	27.6	41.7
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20-Jun-21 02:55:48 PM	0.12	533	0.02	1.1	27.6	41.5
20-Jun-21 02:56:49 PM	0.12	532	0.02	1.1	27.6	41.5
20-Jun-21 02:57:50 PM	0.12	527	0.02	1.2	27.5	41.4
20-Jun-21 02:58:51 PM	0.12	524	0.02	1.2	27.6	41.4
20-Jun-21 02:59:52 PM	0.12	525	0.02	1.2	27.7	41.5
20-Jun-21 03:00:53 PM	0.12	525	0.02	1.2	27.8	41.5
20-Jun-21 03:01:54 PM	0.12	523	0.02	1.2	27.8	41.3
20-Jun-21 03:02:55 PM	0.12	523	0.02	1.2	27.8	41.3

20-Jun-21 03:03:56 PM	0.12	522	0.02	1.2	27.9	41.3
20-Jun-21 03:04:57 PM	0.12	523	0.02	1.2	27.8	41.2
20-Jun-21 03:05:58 PM	0.12	518	0.02	1.2	27.8	41.1
20-Jun-21 03:06:59 PM	0.12	518	0.02	1.1	27.9	41.0
20-Jun-21 03:08:00 PM	0.12	516	0.02	1.1	27.9	40.9
20-Jun-21 03:09:01 PM	0.12	518	0.02	1.1	27.9	41.0
20-Jun-21 03:10:02 PM	0.12	517	0.02	1.1	27.8	40.9
20-Jun-21 03:11:03 PM	0.12	515	0.02	1.1	27.9	40.9
20-Jun-21 03:12:04 PM	0.12	513	0.02	1.2	27.9	40.9
20-Jun-21 03:13:05 PM	0.12	512	0.02	1.2	28.0	40.9
20-Jun-21 03:14:06 PM	0.12	513	0.02	1.1	28.0	40.9
20-Jun-21 03:15:07 PM	0.12	514	0.02	1.2	28.0	40.9
20-Jun-21 03:16:08 PM	0.12	511	0.02	1.1	28.0	40.7
20-Jun-21 03:17:09 PM	0.12	515	0.02	1.1	27.9	40.7
20-Jun-21 03:18:10 PM	0.12	512	0.02	1.1	27.9	40.7
20-Jun-21 03:19:11 PM	0.12	511	0.02	1.1	27.9	40.6
20-Jun-21 03:20:12 PM	0.12	515	0.01	1.1	27.9	40.6
20-Jun-21 03:21:13 PM	0.12	511	0.02	1.1	27.9	40.5
20-Jun-21 03:22:14 PM	0.12	513	0.02	1.1	28.0	40.6
20-Jun-21 03:23:15 PM	0.12	509	0.02	1.1	27.9	40.5
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20-Jun-21 03:25:17 PM	0.12	511	0.02	1.1	28.0	40.6
20-Jun-21 03:26:18 PM	0.12	511	0.02	1.1	28.0	40.5
20-Jun-21 03:27:19 PM	0.12	511	0.02	1.1	27.9	40.4
20-Jun-21 03:28:20 PM	0.12	508	0.01	1.1	28.0	40.4
20-Jun-21 03:29:21 PM	0.12	510	0.02	1.1	27.9	40.4
20-Jun-21 03:30:22 PM	0.12	517	0.02	1.1	27.8	40.3
20-Jun-21 03:31:23 PM	0.12	514	0.02	1.1	27.9	40.4
20-Jun-21 03:32:24 PM	0.12	515	0.02	1.1	28.0	40.3
20-Jun-21 03:33:25 PM	0.12	513	0.02	1.1	28.0	40.3
20-Jun-21 03:34:26 PM	0.12	513	0.02	1.1	28.0	40.3
20-Jun-21 03:35:27 PM	0.12	513	0.02	1.1	28.0	40.3
20-Jun-21 03:36:28 PM	0.12	514	0.02	1.1	28.1	40.3
20-Jun-21 03:37:29 PM	0.12	511	0.02	1.1	28.1	40.3
20-Jun-21 03:38:30 PM	0.12	512	0.02	1.1	28.1	40.3
20-Jun-21 03:39:31 PM	0.12	513	0.02	1.1	28.1	40.3
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20-Jun-21 03:41:33 PM	0.12	512	0.02	1.1	27.9	40.2
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20-Jun-21 03:45:37 PM	0.11	508	0.01	1.1	28.0	40.1
20-Jun-21 03:46:38 PM	0.11	507	0.01	1.1	28.0	40.0
20-Jun-21 03:47:39 PM	0.12	508	0.01	1.1	28.1	40.2
20-Jun-21 03:48:40 PM	0.12	507	0.02	1.1	28.0	40.1
20-Jun-21 03:49:41 PM	0.12	508	0.01	1.1	28.1	40.2
20-Jun-21 03:50:42 PM	0.11	508	0.01	1.1	28.1	40.1
20-Jun-21 03:51:43 PM	0.11	502	0.02	1.1	28.0	40.0
20-Jun-21 03:52:44 PM	0.11	504	0.02	1.0	27.9	40.0
20-Jun-21 03:53:45 PM	0.11	507	0.01	1.0	28.1	40.1
20-Jun-21 03:54:46 PM	0.11	505	0.02	1.0	28.0	40.0
20-Jun-21 03:55:47 PM	0.11	504	0.02	1.1	28.2	40.0
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20-Jun-21 03:59:51 PM	0.11	505	0.01	1.1	28.2	40.0
20-Jun-21 04:00:52 PM	0.11	504	0.02	1.1	28.1	39.9

20-Jun-21 04:01:53 PM	0.11	505	0.02	1.1	28.1	39.9
20-Jun-21 04:02:54 PM	0.11	506	0.02	1.1	28.2	40.0
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20-Jun-21 04:05:57 PM	0.11	504	0.02	1.1	28.1	39.7
20-Jun-21 04:06:58 PM	0.11	502	0.01	1.1	28.2	39.9
20-Jun-21 04:07:59 PM	0.11	503	0.02	1.1	28.2	39.7
20-Jun-21 04:09:00 PM	0.11	504	0.02	1.0	28.1	39.8
20-Jun-21 04:10:01 PM	0.11	503	0.01	1.0	28.2	39.8
20-Jun-21 04:11:02 PM	0.11	503	0.02	1.0	28.2	39.9
20-Jun-21 04:12:03 PM	0.11	501	0.02	1.0	28.2	39.8
20-Jun-21 04:13:04 PM	0.11	502	0.01	1.0	28.2	39.9
20-Jun-21 04:14:05 PM	0.11	502	0.02	1.0	28.1	39.7
20-Jun-21 04:15:06 PM	0.11	503	0.02	1.0	28.2	40.0
20-Jun-21 04:16:07 PM	0.11	503	0.02	1.0	28.0	39.7
20-Jun-21 04:17:08 PM	0.11	502	0.02	1.0	28.1	39.7
20-Jun-21 04:18:09 PM	0.11	499	0.02	1.0	28.2	39.7
20-Jun-21 04:19:10 PM	0.11	501	0.02	1.1	28.2	39.8
20-Jun-21 04:20:11 PM	0.11	500	0.02	1.1	28.0	39.7
20-Jun-21 04:21:12 PM	0.11	513	0.02	1.1	28.1	39.7
20-Jun-21 04:22:13 PM	0.11	536	0.02	1.1	28.1	39.9
20-Jun-21 04:23:14 PM	0.11	547	0.02	1.1	28.0	40.1
20-Jun-21 04:24:15 PM	0.11	554	0.02	1.1	28.1	40.2
20-Jun-21 04:25:16 PM	0.11	551	0.02	1.0	28.2	40.2
20-Jun-21 04:26:17 PM	0.11	550	0.02	1.1	28.2	40.1
20-Jun-21 04:27:18 PM	0.11	539	0.02	1.1	28.2	40.0
20-Jun-21 04:28:19 PM	0.11	536	0.02	1.1	28.1	40.0
20-Jun-21 04:29:20 PM	0.11	535	0.02	1.0	28.0	40.0
20-Jun-21 04:30:21 PM	0.11	533	0.02	1.0	28.0	39.9
20-Jun-21 04:31:22 PM	0.11	527	0.02	1.0	28.0	39.9
20-Jun-21 04:32:23 PM	0.11	526	0.02	1.0	28.1	40.0
20-Jun-21 04:33:24 PM	0.11	524	0.02	1.0	28.0	39.9
20-Jun-21 04:34:25 PM	0.11	522	0.02	1.0	28.1	40.0
20-Jun-21 04:35:26 PM	0.11	522	0.02	1.0	28.1	40.0
20-Jun-21 04:36:27 PM	0.11	518	0.02	1.0	28.1	40.0
20-Jun-21 04:37:28 PM	0.11	518	0.02	1.1	28.1	40.0
20-Jun-21 04:38:29 PM	0.11	515	0.02	1.1	28.1	40.0
20-Jun-21 04:39:30 PM	0.11	513	0.02	1.0	28.1	39.9
20-Jun-21 04:40:31 PM	0.11	511	0.02	1.0	28.1	39.9
20-Jun-21 04:41:32 PM	0.11	511	0.02	1.0	28.1	39.9
20-Jun-21 04:42:33 PM	0.11	510	0.02	1.0	28.1	39.8
20-Jun-21 04:43:34 PM	0.11	511	0.02	1.0	28.1	40.0
20-Jun-21 04:44:35 PM	0.11	507	0.02	1.0	28.0	39.8
20-Jun-21 04:45:36 PM	0.11	508	0.02	1.0	28.2	40.0
20-Jun-21 04:46:37 PM	0.11	503	0.02	1.0	28.1	39.9
20-Jun-21 04:47:38 PM	0.11	506	0.02	1.0	28.2	40.1
20-Jun-21 04:48:39 PM	0.11	504	0.01	1.0	28.2	40.0
20-Jun-21 04:49:40 PM	0.11	503	0.02	1.0	28.1	39.9
20-Jun-21 04:50:41 PM	0.11	502	0.02	1.1	28.1	39.9
20-Jun-21 04:51:42 PM	0.11	503	0.02	1.1	28.2	39.9
20-Jun-21 04:52:43 PM	0.11	502	0.02	1.1	28.2	40.0
20-Jun-21 04:53:44 PM	0.11	501	0.02	1.0	28.1	39.9
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20-Jun-21 04:55:46 PM	0.11	501	0.02	1.1	28.2	39.8
20-Jun-21 04:56:47 PM	0.11	498	0.02	1.1	28.2	39.8
20-Jun-21 04:57:48 PM	0.11	500	0.02	1.0	28.2	39.8
20-Jun-21 04:58:49 PM	0.11	497	0.02	1.1	28.1	39.7

20-Jun-21 04:59:50 PM	0.11	497	0.02	1.0	28.2	39.8
20-Jun-21 05:00:51 PM	0.11	499	0.01	1.0	28.2	39.8
20-Jun-21 05:01:52 PM	0.11	496	0.01	1.0	28.1	39.7
20-Jun-21 05:02:53 PM	0.11	496	0.02	1.0	28.1	39.6
20-Jun-21 05:03:54 PM	0.11	496	0.01	1.0	28.0	39.6
20-Jun-21 05:04:55 PM	0.11	497	0.01	1.0	28.2	39.8
20-Jun-21 05:05:56 PM	0.11	497	0.01	1.0	28.0	39.7
20-Jun-21 05:06:57 PM	0.11	494	0.01	1.0	28.1	39.7
20-Jun-21 05:07:58 PM	0.11	494	0.01	1.0	28.0	39.7
20-Jun-21 05:08:59 PM	0.11	492	0.02	1.0	28.1	39.5
20-Jun-21 05:10:00 PM	0.11	493	0.02	1.0	28.1	39.5
20-Jun-21 05:11:01 PM	0.11	494	0.02	1.0	28.0	39.7
20-Jun-21 05:12:02 PM	0.11	494	0.01	1.0	28.0	39.7
20-Jun-21 05:13:03 PM	0.11	492	0.02	1.0	28.1	39.8
20-Jun-21 05:14:04 PM	0.11	494	0.02	1.0	27.9	39.6
20-Jun-21 05:15:05 PM	0.11	489	0.02	1.0	28.0	39.5
20-Jun-21 05:16:06 PM	0.11	491	0.02	1.0	28.0	39.7
20-Jun-21 05:17:07 PM	0.11	494	0.02	1.0	28.1	40.0
20-Jun-21 05:18:08 PM	0.11	492	0.02	1.0	28.0	39.7
20-Jun-21 05:19:09 PM	0.11	492	0.02	1.0	28.0	39.9
20-Jun-21 05:20:10 PM	0.11	489	0.02	1.0	28.0	39.7
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20-Jun-21 05:23:13 PM	0.11	488	0.02	1.0	28.0	39.6
20-Jun-21 05:24:14 PM	0.11	489	0.02	1.0	28.1	39.6
20-Jun-21 05:25:15 PM	0.11	489	0.01	1.0	28.0	39.9
20-Jun-21 05:26:16 PM	0.11	489	0.02	1.0	28.0	39.8
20-Jun-21 05:27:17 PM	0.11	492	0.02	1.0	28.1	40.1
20-Jun-21 05:28:18 PM	0.11	488	0.01	1.0	28.1	39.8
20-Jun-21 05:29:19 PM	0.11	485	0.02	1.0	28.0	39.6
20-Jun-21 05:30:20 PM	0.11	486	0.02	1.0	28.1	39.9
20-Jun-21 05:31:21 PM	0.11	488	0.02	1.0	28.1	40.0
20-Jun-21 05:32:22 PM	0.11	482	0.03	1.0	28.1	39.9
20-Jun-21 05:33:23 PM	0.11	475	0.03	1.0	28.1	40.0
20-Jun-21 05:34:24 PM	0.11	473	0.03	1.0	28.1	39.9
20-Jun-21 05:35:25 PM	0.11	472	0.03	1.0	28.1	40.1
20-Jun-21 05:36:26 PM	0.11	474	0.03	1.0	28.0	39.9
20-Jun-21 05:37:27 PM	0.11	474	0.03	1.0	28.0	40.0
20-Jun-21 05:38:28 PM	0.11	472	0.03	1.0	28.1	39.9
20-Jun-21 05:39:29 PM	0.11	475	0.03	1.0	28.0	40.1
20-Jun-21 05:40:30 PM	0.11	474	0.03	1.0	28.0	39.8
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20-Jun-21 05:43:33 PM	0.11	474	0.03	1.0	28.1	40.1
20-Jun-21 05:44:34 PM	0.11	474	0.03	1.0	28.1	40.1
20-Jun-21 05:45:35 PM	0.11	474	0.03	1.0	28.1	40.1
20-Jun-21 05:46:36 PM	0.11	472	0.03	1.0	28.1	39.8
20-Jun-21 05:47:37 PM	0.11	471	0.03	1.0	28.1	39.9
20-Jun-21 05:48:38 PM	0.11	471	0.03	1.0	28.1	40.1
20-Jun-21 05:49:39 PM	0.11	473	0.03	1.0	28.1	40.0
20-Jun-21 05:50:40 PM	0.11	472	0.03	1.0	28.1	40.0
20-Jun-21 05:51:41 PM	0.11	472	0.03	1.0	28.1	40.0
20-Jun-21 05:52:42 PM	0.11	471	0.03	1.0	28.1	40.1
20-Jun-21 05:53:43 PM	0.11	471	0.03	1.0	28.1	40.2
20-Jun-21 05:54:44 PM	0.11	472	0.03	1.0	28.1	40.0
20-Jun-21 05:55:45 PM	0.11	470	0.03	1.0	28.1	40.2
20-Jun-21 05:56:46 PM	0.11	471	0.03	1.0	28.1	40.1

20-Jun-21 05:57:47 PM	0.11	468	0.03	1.0	28.1	39.9
20-Jun-21 05:58:48 PM	0.11	466	0.03	1.0	28.1	40.1
20-Jun-21 05:59:49 PM	0.11	470	0.03	1.0	28.1	40.2
20-Jun-21 06:00:50 PM	0.11	469	0.03	1.0	28.1	40.0
20-Jun-21 06:01:51 PM	0.11	469	0.03	1.0	28.1	40.0
20-Jun-21 06:02:52 PM	0.11	469	0.03	1.0	28.1	40.2
20-Jun-21 06:03:53 PM	0.11	468	0.03	1.0	28.1	40.3
20-Jun-21 06:04:54 PM	0.11	469	0.03	1.0	28.1	40.0
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20-Jun-21 06:06:56 PM	0.11	469	0.03	1.0	28.1	40.2
20-Jun-21 06:07:57 PM	0.11	467	0.03	1.0	28.1	40.3
20-Jun-21 06:08:58 PM	0.11	468	0.03	1.0	28.1	40.4
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20-Jun-21 06:13:02 PM	0.11	469	0.03	1.0	28.1	40.2
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20-Jun-21 06:18:07 PM	0.11	469	0.03	1.0	28.0	40.3
20-Jun-21 06:19:08 PM	0.11	469	0.03	1.0	28.0	40.3
20-Jun-21 06:20:09 PM	0.11	469	0.03	1.0	28.0	40.3
20-Jun-21 06:21:10 PM	0.11	467	0.03	1.0	28.1	40.3
20-Jun-21 06:22:11 PM	0.11	469	0.03	1.0	28.1	40.5
20-Jun-21 06:23:12 PM	0.11	469	0.03	1.0	28.0	40.3
20-Jun-21 06:24:13 PM	0.11	467	0.03	1.0	28.1	40.3
20-Jun-21 06:25:14 PM	0.11	466	0.03	1.0	28.1	40.5
20-Jun-21 06:26:15 PM	0.11	464	0.03	1.0	28.1	40.4
20-Jun-21 06:27:16 PM	0.11	465	0.03	1.0	28.1	40.4
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20-Jun-21 06:29:18 PM	0.11	468	0.03	1.0	28.1	40.5
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20-Jun-21 06:31:20 PM	0.11	468	0.03	1.0	28.0	40.5
20-Jun-21 06:32:21 PM	0.11	467	0.03	1.0	28.0	40.4
20-Jun-21 06:33:22 PM	0.11	467	0.03	1.0	28.0	40.4
20-Jun-21 06:34:23 PM	0.11	469	0.03	1.0	28.0	40.5
20-Jun-21 06:35:24 PM	0.11	468	0.03	1.0	28.0	40.5
20-Jun-21 06:36:25 PM	0.11	467	0.03	0.9	28.0	40.7
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20-Jun-21 06:38:27 PM	0.11	468	0.03	1.0	28.0	40.6
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20-Jun-21 06:40:29 PM	0.11	468	0.03	0.9	27.9	40.6
20-Jun-21 06:41:30 PM	0.11	466	0.03	0.9	27.9	40.6
20-Jun-21 06:42:31 PM	0.11	467	0.03	0.9	27.8	40.6
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20-Jun-21 06:44:33 PM	0.11	467	0.03	0.9	27.9	40.8
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20-Jun-21 06:53:42 PM	0.11	466	0.03	0.9	27.9	41.0
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20-Jun-21 06:55:44 PM	0.11	464	0.03	1.0	27.9	41.0
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20-Jun-21 08:25:12 PM	0.11	463	0.03	0.9	27.6	42.0
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20-Jun-21 08:29:16 PM	0.11	460	0.03	0.9	27.6	42.0
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20-Jun-21 08:44:31 PM	0.11	462	0.03	1.0	27.7	42.0
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20-Jun-21 08:46:33 PM	0.11	460	0.03	0.9	27.6	42.0
20-Jun-21 08:47:34 PM	0.11	461	0.03	1.0	27.5	42.0
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20-Jun-21 08:57:44 PM	0.11	463	0.03	0.9	27.7	42.0
20-Jun-21 08:58:45 PM	0.11	460	0.03	1.0	27.5	41.9
20-Jun-21 08:59:46 PM	0.11	462	0.03	1.0	27.5	41.9
20-Jun-21 09:00:47 PM	0.11	461	0.03	1.0	27.5	41.9
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20-Jun-21 09:05:52 PM	0.11	462	0.03	1.0	27.5	42.2
20-Jun-21 09:06:53 PM	0.11	463	0.03	0.9	27.4	42.2
20-Jun-21 09:07:54 PM	0.11	463	0.03	0.9	27.4	42.2
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20-Jun-21 09:11:58 PM	0.11	462	0.03	0.9	27.6	42.4
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20-Jun-21 09:14:00 PM	0.11	460	0.03	0.9	27.4	42.3
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20-Jun-21 09:16:02 PM	0.11	463	0.03	1.0	27.5	42.3
20-Jun-21 09:17:03 PM	0.11	462	0.03	1.0	27.5	42.3
20-Jun-21 09:18:04 PM	0.11	461	0.03	1.0	27.5	42.3
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20-Jun-21 09:20:06 PM	0.11	464	0.03	1.0	27.4	42.3
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20-Jun-21 09:22:08 PM	0.11	463	0.03	1.0	27.5	42.4
20-Jun-21 09:23:09 PM	0.11	462	0.03	0.9	27.3	42.4
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20-Jun-21 09:26:12 PM	0.11	464	0.03	1.0	27.4	42.4
20-Jun-21 09:27:13 PM	0.11	462	0.03	1.0	27.4	42.4
20-Jun-21 09:28:14 PM	0.11	463	0.03	0.9	27.3	42.4
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20-Jun-21 09:31:17 PM	0.11	463	0.03	1.0	27.4	42.5
20-Jun-21 09:32:18 PM	0.11	461	0.03	1.0	27.3	42.4
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20-Jun-21 09:42:28 PM	0.11	460	0.03	1.0	27.4	42.5
20-Jun-21 09:43:29 PM	0.11	462	0.03	1.0	27.5	42.5
20-Jun-21 09:44:30 PM	0.12	462	0.03	1.0	27.6	42.5
20-Jun-21 09:45:31 PM	0.11	460	0.03	1.0	27.4	42.5
20-Jun-21 09:46:32 PM	0.11	463	0.03	1.0	27.4	42.5
20-Jun-21 09:47:33 PM	0.11	463	0.03	1.0	27.3	42.4
20-Jun-21 09:48:34 PM	0.11	460	0.03	1.1	27.4	42.4

20-Jun-21 09:49:35 PM	0.11	459	0.03	1.0	27.4	42.4
20-Jun-21 09:50:36 PM	0.11	461	0.03	1.0	27.5	42.4
20-Jun-21 09:51:37 PM	0.11	462	0.03	1.0	27.5	42.4
20-Jun-21 09:52:38 PM	0.11	463	0.03	1.0	27.5	42.3
20-Jun-21 09:53:39 PM	0.11	462	0.03	1.0	27.4	42.3
20-Jun-21 09:54:40 PM	0.11	461	0.03	1.0	27.5	42.2
20-Jun-21 09:55:41 PM	0.11	465	0.03	1.0	27.4	42.2
20-Jun-21 09:56:42 PM	0.12	464	0.03	1.0	27.5	42.3
20-Jun-21 09:57:43 PM	0.11	464	0.03	1.0	27.4	42.3
20-Jun-21 09:58:44 PM	0.12	465	0.03	1.1	27.3	42.2
20-Jun-21 09:59:45 PM	0.12	462	0.03	1.0	27.4	42.3
20-Jun-21 10:00:46 PM	0.12	464	0.03	1.0	27.4	42.4
20-Jun-21 10:01:47 PM	0.12	463	0.03	1.0	27.4	42.4
20-Jun-21 10:02:48 PM	0.12	465	0.03	1.0	27.4	42.4
20-Jun-21 10:03:49 PM	0.12	462	0.03	1.0	27.4	42.4
20-Jun-21 10:04:50 PM	0.12	462	0.03	1.0	27.4	42.4
20-Jun-21 10:05:51 PM	0.12	465	0.03	1.0	27.3	42.4
20-Jun-21 10:06:52 PM	0.12	464	0.03	1.0	27.3	42.4
20-Jun-21 10:07:53 PM	0.12	465	0.03	1.0	27.3	42.3
20-Jun-21 10:08:54 PM	0.12	464	0.03	1.1	27.4	42.4
20-Jun-21 10:09:55 PM	0.12	463	0.03	1.1	27.4	42.3
20-Jun-21 10:10:56 PM	0.12	463	0.03	1.0	27.3	42.3
20-Jun-21 10:11:57 PM	0.12	462	0.03	1.0	27.3	42.2
20-Jun-21 10:12:58 PM	0.12	464	0.03	1.0	27.4	42.3
20-Jun-21 10:13:59 PM	0.12	463	0.03	1.0	27.4	42.3
20-Jun-21 10:15:00 PM	0.12	464	0.03	1.1	27.2	42.2
20-Jun-21 10:16:01 PM	0.12	463	0.03	1.1	27.2	42.2
20-Jun-21 10:17:02 PM	0.12	464	0.03	1.1	27.4	42.3
20-Jun-21 10:18:03 PM	0.12	462	0.03	1.1	27.5	42.4
20-Jun-21 10:19:04 PM	0.12	462	0.03	1.1	27.5	42.4
20-Jun-21 10:20:05 PM	0.12	464	0.03	1.1	27.5	42.3
20-Jun-21 10:21:06 PM	0.12	462	0.03	1.1	27.4	42.2
20-Jun-21 10:22:07 PM	0.12	461	0.03	1.1	27.4	42.2
20-Jun-21 10:23:08 PM	0.12	462	0.03	1.0	27.5	42.3
20-Jun-21 10:24:09 PM	0.12	463	0.03	1.0	27.4	42.2
20-Jun-21 10:25:10 PM	0.12	465	0.03	1.1	27.3	42.1
20-Jun-21 10:26:11 PM	0.12	462	0.03	1.1	27.4	42.1
20-Jun-21 10:27:12 PM	0.12	465	0.03	1.1	27.4	42.2
20-Jun-21 10:28:13 PM	0.12	463	0.03	1.1	27.2	42.0
20-Jun-21 10:29:14 PM	0.12	464	0.03	1.0	27.3	42.0
20-Jun-21 10:30:15 PM	0.12	465	0.03	1.0	27.3	42.0
20-Jun-21 10:31:16 PM	0.12	462	0.03	1.1	27.3	42.1
20-Jun-21 10:32:17 PM	0.12	462	0.03	1.1	27.4	42.2
20-Jun-21 10:33:18 PM	0.12	463	0.03	1.0	27.3	42.1
20-Jun-21 10:34:19 PM	0.12	464	0.03	1.0	27.2	42.1
20-Jun-21 10:35:20 PM	0.12	465	0.03	1.1	27.2	42.1
20-Jun-21 10:36:21 PM	0.12	463	0.03	1.1	27.4	42.3
20-Jun-21 10:37:22 PM	0.12	466	0.03	1.1	27.2	42.3
20-Jun-21 10:38:23 PM	0.12	465	0.03	1.1	27.2	42.2
20-Jun-21 10:39:24 PM	0.12	465	0.03	1.0	27.3	42.2
20-Jun-21 10:40:25 PM	0.12	465	0.03	1.0	27.3	42.3
20-Jun-21 10:41:26 PM	0.12	465	0.03	1.0	27.3	42.3
20-Jun-21 10:42:27 PM	0.12	466	0.03	1.0	27.3	42.3
20-Jun-21 10:43:28 PM	0.12	462	0.03	1.0	27.3	42.3
20-Jun-21 10:44:29 PM	0.12	464	0.03	1.1	27.3	42.2
20-Jun-21 10:45:30 PM	0.12	462	0.03	1.1	27.3	42.2
20-Jun-21 10:46:31 PM	0.12	464	0.03	1.0	27.4	42.0

20-Jun-21 10:47:32 PM	0.12	461	0.03	1.1	27.5	42.2
20-Jun-21 10:48:33 PM	0.12	462	0.03	1.1	27.5	42.2
20-Jun-21 10:49:34 PM	0.12	466	0.03	1.1	27.3	42.1
20-Jun-21 10:50:35 PM	0.12	464	0.03	1.1	27.3	42.0
20-Jun-21 10:51:36 PM	0.12	462	0.03	1.1	27.4	42.1
20-Jun-21 10:52:37 PM	0.12	463	0.03	1.1	27.5	42.2
20-Jun-21 10:53:38 PM	0.12	462	0.03	1.1	27.4	42.1
20-Jun-21 10:54:39 PM	0.12	465	0.03	1.1	27.3	42.1
20-Jun-21 10:55:40 PM	0.12	466	0.03	1.1	27.4	42.1
20-Jun-21 10:56:41 PM	0.12	464	0.03	1.1	27.4	42.2
20-Jun-21 10:57:42 PM	0.12	463	0.03	1.1	27.4	42.1
20-Jun-21 10:58:43 PM	0.12	464	0.03	1.1	27.4	42.1
20-Jun-21 10:59:44 PM	0.12	463	0.03	1.1	27.2	42.0
20-Jun-21 11:00:45 PM	0.12	462	0.03	1.1	27.2	41.9
20-Jun-21 11:01:46 PM	0.12	465	0.03	1.1	27.3	42.0
20-Jun-21 11:02:47 PM	0.12	463	0.03	1.1	27.4	42.0
20-Jun-21 11:03:48 PM	0.12	463	0.03	1.1	27.3	42.0
20-Jun-21 11:04:49 PM	0.12	464	0.03	1.1	27.4	42.0
20-Jun-21 11:05:50 PM	0.12	462	0.03	1.1	27.4	41.8
20-Jun-21 11:06:51 PM	0.12	465	0.03	1.1	27.4	41.9
20-Jun-21 11:07:52 PM	0.12	463	0.03	1.1	27.3	41.8
20-Jun-21 11:08:53 PM	0.11	464	0.03	1.1	27.4	41.9
20-Jun-21 11:09:54 PM	0.12	463	0.03	1.1	27.3	41.9
20-Jun-21 11:10:55 PM	0.12	464	0.03	1.1	27.4	41.9
20-Jun-21 11:11:56 PM	0.12	464	0.03	1.1	27.3	41.9
20-Jun-21 11:12:57 PM	0.12	463	0.03	1.0	27.3	41.8
20-Jun-21 11:13:58 PM	0.12	463	0.03	1.1	27.2	41.9
20-Jun-21 11:14:59 PM	0.12	465	0.03	1.1	27.2	41.8
20-Jun-21 11:16:00 PM	0.12	463	0.03	1.0	27.3	41.9
20-Jun-21 11:17:01 PM	0.12	463	0.03	1.1	27.2	41.9
20-Jun-21 11:18:02 PM	0.12	462	0.03	1.1	27.2	41.7
20-Jun-21 11:19:03 PM	0.12	464	0.03	1.1	27.3	41.8
20-Jun-21 11:20:04 PM	0.12	462	0.03	1.1	27.3	41.8
20-Jun-21 11:21:05 PM	0.12	462	0.03	1.1	27.3	42.0
20-Jun-21 11:22:06 PM	0.12	461	0.03	1.1	27.3	41.9
20-Jun-21 11:23:07 PM	0.12	462	0.03	1.0	27.3	42.0
20-Jun-21 11:24:08 PM	0.12	463	0.03	1.0	27.2	42.0
20-Jun-21 11:25:09 PM	0.12	464	0.03	1.0	27.3	41.9
20-Jun-21 11:26:10 PM	0.12	462	0.03	1.1	27.4	42.0
20-Jun-21 11:27:11 PM	0.12	463	0.03	1.1	27.4	42.0
20-Jun-21 11:28:12 PM	0.12	463	0.03	1.1	27.3	41.9
20-Jun-21 11:29:13 PM	0.12	465	0.03	1.1	27.2	41.9
20-Jun-21 11:30:14 PM	0.12	464	0.03	1.1	27.2	41.8
20-Jun-21 11:31:15 PM	0.12	464	0.03	1.0	27.3	41.8
20-Jun-21 11:32:16 PM	0.12	464	0.03	1.0	27.4	41.9
20-Jun-21 11:33:17 PM	0.12	463	0.03	1.0	27.4	41.9
20-Jun-21 11:34:18 PM	0.12	465	0.03	1.1	27.2	41.8
20-Jun-21 11:35:19 PM	0.12	463	0.03	1.1	27.4	41.9
20-Jun-21 11:36:20 PM	0.12	463	0.03	1.0	27.1	41.7
20-Jun-21 11:37:21 PM	0.12	466	0.03	1.0	27.2	41.7
20-Jun-21 11:38:22 PM	0.12	466	0.03	1.1	27.2	41.7
20-Jun-21 11:39:23 PM	0.12	467	0.03	1.0	27.2	41.9
20-Jun-21 11:40:24 PM	0.12	466	0.03	1.0	27.2	41.8
20-Jun-21 11:41:25 PM	0.12	462	0.03	1.0	27.2	42.0
20-Jun-21 11:42:26 PM	0.12	465	0.03	1.0	27.2	41.9
20-Jun-21 11:43:27 PM	0.12	461	0.03	1.0	27.2	42.0
20-Jun-21 11:44:28 PM	0.12	465	0.03	1.0	27.1	41.9

20-Jun-21 11:45:29 PM	0.12	462	0.03	1.0	27.2	41.9
20-Jun-21 11:46:30 PM	0.12	464	0.03	1.0	27.1	41.9
20-Jun-21 11:47:31 PM	0.12	464	0.03	1.0	27.2	41.9
20-Jun-21 11:48:32 PM	0.12	467	0.03	1.0	27.0	41.8
20-Jun-21 11:49:33 PM	0.12	467	0.03	1.0	27.0	41.9
20-Jun-21 11:50:34 PM	0.12	465	0.03	0.9	27.1	42.1
20-Jun-21 11:51:35 PM	0.12	465	0.03	0.9	27.1	42.0
20-Jun-21 11:52:36 PM	0.12	465	0.03	1.0	27.0	41.9
20-Jun-21 11:53:37 PM	0.12	466	0.03	1.0	27.0	42.0
20-Jun-21 11:54:38 PM	0.12	463	0.03	1.0	27.0	42.0
20-Jun-21 11:55:39 PM	0.12	465	0.03	1.0	27.0	42.0
20-Jun-21 11:56:40 PM	0.12	464	0.03	1.0	27.0	41.9
20-Jun-21 11:57:41 PM	0.12	463	0.03	1.0	27.1	42.1
20-Jun-21 11:58:42 PM	0.12	462	0.03	1.0	27.2	42.0
20-Jun-21 11:59:43 PM	0.12	461	0.03	1.0	27.3	42.2
21-Jun-21 12:00:44 AM	0.12	465	0.03	1.1	26.9	42.0
21-Jun-21 12:01:45 AM	0.12	466	0.03	1.0	26.9	41.8
21-Jun-21 12:02:46 AM	0.12	466	0.03	1.0	26.9	41.9
21-Jun-21 12:03:47 AM	0.12	464	0.03	1.0	26.9	41.8
21-Jun-21 12:04:48 AM	0.12	464	0.03	1.0	26.9	41.9
21-Jun-21 12:05:49 AM	0.12	466	0.03	1.0	27.0	41.9
21-Jun-21 12:06:50 AM	0.12	466	0.03	1.1	27.0	42.1
21-Jun-21 12:07:51 AM	0.12	465	0.03	1.0	27.1	42.1
21-Jun-21 12:08:52 AM	0.12	465	0.03	1.0	27.1	42.2
21-Jun-21 12:09:53 AM	0.12	466	0.03	1.0	26.8	42.1
21-Jun-21 12:10:54 AM	0.12	465	0.03	1.0	26.9	42.0
21-Jun-21 12:11:55 AM	0.12	464	0.03	1.0	27.0	42.1
21-Jun-21 12:12:56 AM	0.12	464	0.03	1.0	27.1	42.2
21-Jun-21 12:13:57 AM	0.12	461	0.03	1.0	26.9	42.1
21-Jun-21 12:14:58 AM	0.12	466	0.03	1.0	26.9	42.1
21-Jun-21 12:15:59 AM	0.12	465	0.03	1.0	27.0	42.2
21-Jun-21 12:17:00 AM	0.12	463	0.03	1.0	27.1	42.2
21-Jun-21 12:18:01 AM	0.12	464	0.03	1.0	27.1	42.2
21-Jun-21 12:19:02 AM	0.12	465	0.03	1.1	26.9	42.0
21-Jun-21 12:20:03 AM	0.12	463	0.03	1.1	27.1	42.1
21-Jun-21 12:21:04 AM	0.12	465	0.03	1.1	27.1	42.2
21-Jun-21 12:22:05 AM	0.12	464	0.03	1.1	27.0	42.1
21-Jun-21 12:23:06 AM	0.12	464	0.03	1.1	27.1	42.1
21-Jun-21 12:24:07 AM	0.12	467	0.03	1.1	26.7	42.1
21-Jun-21 12:25:08 AM	0.12	466	0.03	1.1	26.7	42.1
21-Jun-21 12:26:09 AM	0.12	464	0.03	1.0	26.9	42.2
21-Jun-21 12:27:10 AM	0.12	466	0.03	1.0	26.9	42.4
21-Jun-21 12:28:11 AM	0.12	464	0.03	1.0	27.0	42.4
21-Jun-21 12:29:12 AM	0.12	466	0.03	1.1	27.0	42.4
21-Jun-21 12:30:13 AM	0.12	465	0.03	1.1	27.0	42.4
21-Jun-21 12:31:14 AM	0.12	464	0.03	1.1	27.0	42.4
21-Jun-21 12:32:15 AM	0.12	464	0.03	1.1	26.9	42.4
21-Jun-21 12:33:16 AM	0.12	463	0.03	1.1	26.9	42.4
21-Jun-21 12:34:17 AM	0.12	462	0.03	1.0	27.1	42.5
21-Jun-21 12:35:18 AM	0.12	462	0.03	1.1	27.1	42.4
21-Jun-21 12:36:19 AM	0.12	464	0.03	1.1	27.0	42.4
21-Jun-21 12:37:20 AM	0.12	463	0.03	1.1	27.0	42.3
21-Jun-21 12:38:21 AM	0.12	465	0.03	1.1	26.9	42.3
21-Jun-21 12:39:22 AM	0.12	461	0.03	1.0	27.0	42.3
21-Jun-21 12:40:23 AM	0.12	464	0.03	1.1	26.8	42.3
21-Jun-21 12:41:24 AM	0.12	465	0.03	1.1	26.9	42.2
21-Jun-21 12:42:25 AM	0.12	465	0.03	1.0	26.9	42.3

21-Jun-21 12:43:26 AM	0.12	464	0.03	1.1	26.8	42.2
21-Jun-21 12:44:27 AM	0.12	465	0.03	1.1	26.8	42.2
21-Jun-21 12:45:28 AM	0.12	464	0.03	1.0	27.0	42.4
21-Jun-21 12:46:29 AM	0.12	462	0.03	1.1	26.9	42.4
21-Jun-21 12:47:30 AM	0.12	465	0.03	1.1	26.9	42.5
21-Jun-21 12:48:31 AM	0.12	466	0.03	1.1	26.9	42.4
21-Jun-21 12:49:32 AM	0.12	464	0.03	1.1	27.0	42.6
21-Jun-21 12:50:33 AM	0.12	463	0.03	1.1	27.0	42.5
21-Jun-21 12:51:34 AM	0.12	462	0.03	1.1	27.0	42.5
21-Jun-21 12:52:35 AM	0.12	464	0.03	1.1	26.9	42.5
21-Jun-21 12:53:36 AM	0.12	464	0.03	1.1	26.9	42.4
21-Jun-21 12:54:37 AM	0.12	464	0.03	1.1	27.0	42.5
21-Jun-21 12:55:38 AM	0.12	462	0.03	1.1	27.0	42.5
21-Jun-21 12:56:39 AM	0.12	463	0.03	1.1	26.8	42.4
21-Jun-21 12:57:40 AM	0.12	463	0.03	1.1	26.9	42.3
21-Jun-21 12:58:41 AM	0.12	463	0.03	1.1	27.0	42.4
21-Jun-21 12:59:42 AM	0.12	464	0.03	1.1	27.0	42.4
21-Jun-21 01:00:43 AM	0.12	463	0.03	1.1	27.1	42.5
21-Jun-21 01:01:44 AM	0.12	464	0.03	1.1	26.9	42.4
21-Jun-21 01:02:45 AM	0.12	465	0.03	1.1	26.9	42.2
21-Jun-21 01:03:46 AM	0.12	465	0.03	1.1	27.0	42.3
21-Jun-21 01:04:47 AM	0.12	465	0.03	1.1	27.0	42.3
21-Jun-21 01:05:48 AM	0.12	465	0.03	1.1	26.9	42.2
21-Jun-21 01:06:49 AM	0.12	463	0.03	1.1	26.8	42.1
21-Jun-21 01:07:50 AM	0.12	462	0.03	1.1	26.8	42.1
21-Jun-21 01:08:51 AM	0.12	465	0.03	1.1	26.9	42.3
21-Jun-21 01:09:52 AM	0.12	465	0.03	1.1	26.9	42.3
21-Jun-21 01:10:53 AM	0.12	465	0.03	1.1	26.9	42.3
21-Jun-21 01:11:54 AM	0.12	464	0.03	1.1	26.9	42.3
21-Jun-21 01:12:55 AM	0.12	466	0.03	1.1	26.8	42.2
21-Jun-21 01:13:56 AM	0.12	467	0.03	1.1	26.7	42.1
21-Jun-21 01:14:57 AM	0.12	466	0.03	1.1	26.7	42.1
21-Jun-21 01:15:58 AM	0.12	466	0.03	1.1	26.7	42.1
21-Jun-21 01:16:59 AM	0.12	466	0.03	1.0	26.8	42.2
21-Jun-21 01:18:00 AM	0.12	464	0.03	1.0	26.8	42.3
21-Jun-21 01:19:01 AM	0.12	465	0.03	1.0	26.6	42.2
21-Jun-21 01:20:02 AM	0.12	465	0.03	1.0	26.7	42.3
21-Jun-21 01:21:03 AM	0.12	462	0.03	1.0	26.8	42.4
21-Jun-21 01:22:04 AM	0.12	465	0.03	1.0	26.7	42.4
21-Jun-21 01:23:05 AM	0.12	465	0.03	1.0	26.7	42.3
21-Jun-21 01:24:06 AM	0.12	465	0.03	1.1	26.6	42.2
21-Jun-21 01:25:07 AM	0.12	463	0.03	1.0	26.8	42.4
21-Jun-21 01:26:08 AM	0.12	465	0.03	1.1	26.6	42.3
21-Jun-21 01:27:09 AM	0.12	465	0.03	1.1	26.6	42.2
21-Jun-21 01:28:10 AM	0.12	462	0.03	1.0	26.9	42.4
21-Jun-21 01:29:11 AM	0.12	462	0.03	1.1	26.8	42.5
21-Jun-21 01:30:12 AM	0.12	464	0.03	1.1	26.7	42.3
21-Jun-21 01:31:13 AM	0.12	464	0.03	1.1	26.7	42.2
21-Jun-21 01:32:14 AM	0.12	462	0.03	1.0	26.7	42.3
21-Jun-21 01:33:15 AM	0.12	464	0.03	1.0	26.7	42.3
21-Jun-21 01:34:16 AM	0.12	462	0.03	1.0	26.6	42.3
21-Jun-21 01:35:17 AM	0.12	461	0.03	1.1	26.9	42.4
21-Jun-21 01:36:18 AM	0.12	462	0.03	1.1	26.6	42.3
21-Jun-21 01:37:19 AM	0.12	464	0.03	1.1	26.6	42.3
21-Jun-21 01:38:20 AM	0.12	462	0.03	1.0	26.7	42.4
21-Jun-21 01:39:21 AM	0.12	459	0.03	1.0	27.0	42.6
21-Jun-21 01:40:22 AM	0.12	461	0.03	1.0	26.8	42.5

21-Jun-21 01:41:23 AM	0.12	463	0.03	1.1	26.8	42.4
21-Jun-21 01:42:24 AM	0.12	462	0.03	1.1	26.8	42.3
21-Jun-21 01:43:25 AM	0.12	464	0.03	1.1	26.7	42.4
21-Jun-21 01:44:26 AM	0.12	461	0.03	1.0	26.7	42.3
21-Jun-21 01:45:27 AM	0.12	461	0.03	1.0	26.7	42.3
21-Jun-21 01:46:28 AM	0.12	462	0.03	1.0	26.6	42.3
21-Jun-21 01:47:29 AM	0.12	461	0.03	1.0	26.5	42.2
21-Jun-21 01:48:30 AM	0.12	462	0.03	1.0	26.7	42.3
21-Jun-21 01:49:31 AM	0.12	460	0.03	1.0	26.8	42.5
21-Jun-21 01:50:32 AM	0.12	462	0.03	1.0	26.7	42.5
21-Jun-21 01:51:33 AM	0.12	462	0.03	1.0	26.7	42.5
21-Jun-21 01:52:34 AM	0.12	460	0.03	1.0	26.7	42.4
21-Jun-21 01:53:35 AM	0.12	461	0.03	1.0	26.8	42.5
21-Jun-21 01:54:36 AM	0.12	464	0.03	1.0	26.6	42.4
21-Jun-21 01:55:37 AM	0.12	462	0.03	1.0	26.7	42.4
21-Jun-21 01:56:38 AM	0.12	461	0.03	1.0	26.8	42.6
21-Jun-21 01:57:39 AM	0.12	462	0.03	1.0	26.6	42.3
21-Jun-21 01:58:40 AM	0.12	462	0.03	1.0	26.5	42.3
21-Jun-21 01:59:41 AM	0.12	460	0.03	1.0	26.5	42.3
21-Jun-21 02:00:42 AM	0.12	461	0.03	1.0	26.4	42.3
21-Jun-21 02:01:43 AM	0.12	461	0.03	1.0	26.6	42.4
21-Jun-21 02:02:44 AM	0.12	460	0.03	1.0	26.6	42.5
21-Jun-21 02:03:45 AM	0.12	463	0.03	1.0	26.4	42.4
21-Jun-21 02:04:46 AM	0.12	463	0.03	1.0	26.5	42.5
21-Jun-21 02:05:47 AM	0.12	463	0.03	1.0	26.4	42.5
21-Jun-21 02:06:48 AM	0.12	460	0.03	1.0	26.5	42.5
21-Jun-21 02:07:49 AM	0.12	462	0.03	1.0	26.4	42.5
21-Jun-21 02:08:50 AM	0.12	461	0.03	1.0	26.4	42.6
21-Jun-21 02:09:51 AM	0.12	462	0.03	1.0	26.3	42.6
21-Jun-21 02:10:52 AM	0.12	463	0.03	1.0	26.4	42.6
21-Jun-21 02:11:53 AM	0.12	459	0.03	0.9	26.4	42.6
21-Jun-21 02:12:54 AM	0.12	460	0.03	0.9	26.5	42.8
21-Jun-21 02:13:55 AM	0.12	461	0.03	1.0	26.5	42.7
21-Jun-21 02:14:56 AM	0.12	457	0.03	0.9	26.6	42.7
21-Jun-21 02:15:57 AM	0.12	459	0.03	0.9	26.4	42.7
21-Jun-21 02:16:58 AM	0.12	459	0.03	1.0	26.6	42.6
21-Jun-21 02:17:59 AM	0.12	460	0.03	1.0	26.4	42.7
21-Jun-21 02:19:00 AM	0.12	460	0.03	1.0	26.5	42.7
21-Jun-21 02:20:01 AM	0.12	461	0.03	1.0	26.3	42.7
21-Jun-21 02:21:02 AM	0.12	459	0.03	0.9	26.2	42.6
21-Jun-21 02:22:03 AM	0.12	459	0.03	0.9	26.2	42.7
21-Jun-21 02:23:04 AM	0.12	462	0.03	0.9	26.4	42.8
21-Jun-21 02:24:05 AM	0.12	462	0.03	0.9	26.4	42.8
21-Jun-21 02:25:06 AM	0.12	458	0.03	0.9	26.3	42.8
21-Jun-21 02:26:07 AM	0.12	461	0.03	0.9	26.3	42.8
21-Jun-21 02:27:08 AM	0.12	459	0.03	0.9	26.3	42.8
21-Jun-21 02:28:09 AM	0.12	460	0.03	0.9	26.3	42.8
21-Jun-21 02:29:10 AM	0.12	459	0.03	0.9	26.3	42.8
21-Jun-21 02:30:11 AM	0.12	457	0.03	0.9	26.5	42.9
21-Jun-21 02:31:12 AM	0.12	460	0.03	0.9	26.4	42.9
21-Jun-21 02:32:13 AM	0.12	458	0.03	0.9	26.4	42.8
21-Jun-21 02:33:14 AM	0.12	460	0.03	0.9	26.3	42.8
21-Jun-21 02:34:15 AM	0.12	459	0.03	0.9	26.5	42.8
21-Jun-21 02:35:16 AM	0.12	459	0.03	1.0	26.3	42.8
21-Jun-21 02:36:17 AM	0.12	457	0.03	1.0	26.2	42.7
21-Jun-21 02:37:18 AM	0.12	459	0.03	0.9	26.3	42.8
21-Jun-21 02:38:19 AM	0.12	457	0.03	0.9	26.4	42.9

21-Jun-21 02:39:20 AM	0.12	457	0.03	0.9	26.5	42.9
21-Jun-21 02:40:21 AM	0.12	460	0.03	1.0	26.2	42.8
21-Jun-21 02:41:22 AM	0.12	460	0.03	0.9	26.3	42.8
21-Jun-21 02:42:23 AM	0.12	459	0.03	0.9	26.3	42.8
21-Jun-21 02:43:24 AM	0.12	460	0.03	0.9	26.2	42.8
21-Jun-21 02:44:25 AM	0.12	460	0.03	0.9	26.2	42.8
21-Jun-21 02:45:26 AM	0.12	459	0.03	0.9	26.3	42.8
21-Jun-21 02:46:27 AM	0.12	457	0.03	0.9	26.2	42.9
21-Jun-21 02:47:28 AM	0.12	457	0.03	0.9	26.2	42.8
21-Jun-21 02:48:29 AM	0.12	456	0.03	0.9	26.5	42.9
21-Jun-21 02:49:30 AM	0.12	458	0.03	0.9	26.2	42.9
21-Jun-21 02:50:31 AM	0.12	455	0.03	1.0	26.3	42.8
21-Jun-21 02:51:32 AM	0.12	459	0.03	0.9	26.3	42.8
21-Jun-21 02:52:33 AM	0.12	457	0.03	0.9	26.2	42.7
21-Jun-21 02:53:34 AM	0.12	458	0.03	0.9	26.3	42.8
21-Jun-21 02:54:35 AM	0.12	458	0.03	0.9	26.3	42.8
21-Jun-21 02:55:36 AM	0.12	459	0.03	0.9	26.2	42.7
21-Jun-21 02:56:37 AM	0.12	458	0.03	0.9	26.3	42.7
21-Jun-21 02:57:38 AM	0.12	458	0.03	0.9	26.2	42.8
21-Jun-21 02:58:39 AM	0.12	456	0.03	0.9	26.3	42.8
21-Jun-21 02:59:40 AM	0.12	457	0.03	0.9	26.2	42.8
21-Jun-21 03:00:41 AM	0.12	456	0.03	0.9	26.2	42.8
21-Jun-21 03:01:42 AM	0.12	458	0.03	0.9	26.3	42.9
21-Jun-21 03:02:43 AM	0.12	455	0.03	0.9	26.2	42.8
21-Jun-21 03:03:44 AM	0.12	458	0.03	0.9	26.2	42.9
21-Jun-21 03:04:45 AM	0.12	458	0.03	0.9	26.2	42.9
21-Jun-21 03:05:46 AM	0.12	458	0.03	0.9	26.3	42.9
21-Jun-21 03:06:47 AM	0.12	460	0.03	0.9	26.3	43.0
21-Jun-21 03:07:48 AM	0.12	455	0.03	0.9	26.4	43.1
21-Jun-21 03:08:49 AM	0.12	456	0.03	0.9	26.2	43.1
21-Jun-21 03:09:50 AM	0.12	458	0.03	0.9	26.2	43.1
21-Jun-21 03:10:51 AM	0.12	457	0.03	0.9	26.4	43.2
21-Jun-21 03:11:52 AM	0.12	455	0.03	0.9	26.5	43.3
21-Jun-21 03:12:53 AM	0.12	456	0.03	1.0	26.3	43.3
21-Jun-21 03:13:54 AM	0.12	457	0.03	0.9	26.4	43.3
21-Jun-21 03:14:55 AM	0.12	458	0.03	0.9	26.2	43.3
21-Jun-21 03:15:56 AM	0.12	460	0.03	0.9	26.3	43.3
21-Jun-21 03:16:57 AM	0.12	458	0.03	0.9	26.4	43.3
21-Jun-21 03:17:58 AM	0.12	460	0.03	0.9	26.3	43.3
21-Jun-21 03:18:59 AM	0.12	460	0.03	0.9	26.4	43.3
21-Jun-21 03:20:00 AM	0.12	459	0.03	0.9	26.4	43.4
21-Jun-21 03:21:01 AM	0.12	456	0.03	0.9	26.4	43.3
21-Jun-21 03:22:02 AM	0.12	458	0.03	0.9	26.4	43.3
21-Jun-21 03:23:03 AM	0.12	457	0.03	0.9	26.4	43.4
21-Jun-21 03:24:04 AM	0.12	458	0.03	0.9	26.4	43.3
21-Jun-21 03:25:05 AM	0.12	458	0.03	0.9	26.3	43.4
21-Jun-21 03:26:06 AM	0.12	456	0.03	0.9	26.1	43.4
21-Jun-21 03:27:07 AM	0.12	458	0.03	0.9	26.2	43.4
21-Jun-21 03:28:08 AM	0.12	457	0.03	0.9	26.2	43.5
21-Jun-21 03:29:09 AM	0.12	458	0.03	0.9	26.4	43.5
21-Jun-21 03:30:10 AM	0.12	457	0.03	0.9	26.3	43.6
21-Jun-21 03:31:11 AM	0.12	457	0.03	0.9	26.4	43.6
21-Jun-21 03:32:12 AM	0.12	458	0.03	0.9	26.3	43.5
21-Jun-21 03:33:13 AM	0.12	458	0.03	0.9	26.2	43.5
21-Jun-21 03:34:14 AM	0.12	458	0.03	0.9	26.6	43.6
21-Jun-21 03:35:15 AM	0.12	459	0.03	1.0	26.4	43.5
21-Jun-21 03:36:16 AM	0.12	455	0.03	1.0	26.3	43.4

21-Jun-21 03:37:17 AM	0.12	457	0.03	1.0	26.4	43.4
21-Jun-21 03:38:18 AM	0.12	457	0.03	0.9	26.4	43.4
21-Jun-21 03:39:19 AM	0.12	458	0.03	1.0	26.3	43.3
21-Jun-21 03:40:20 AM	0.12	459	0.04	1.0	26.2	43.2
21-Jun-21 03:41:21 AM	0.12	458	0.04	0.9	26.2	43.2
21-Jun-21 03:42:22 AM	0.12	460	0.03	0.9	26.4	43.2
21-Jun-21 03:43:23 AM	0.12	457	0.03	0.9	26.2	43.2
21-Jun-21 03:44:24 AM	0.12	459	0.03	0.9	26.2	43.2
21-Jun-21 03:45:25 AM	0.12	457	0.03	0.9	26.3	43.3
21-Jun-21 03:46:26 AM	0.12	460	0.04	0.9	26.2	43.3
21-Jun-21 03:47:27 AM	0.12	460	0.03	0.9	26.2	43.3
21-Jun-21 03:48:28 AM	0.12	459	0.04	0.9	26.1	43.2
21-Jun-21 03:49:29 AM	0.12	458	0.03	0.9	26.2	43.3
21-Jun-21 03:50:30 AM	0.12	459	0.03	0.9	26.3	43.3
21-Jun-21 03:51:31 AM	0.12	461	0.04	0.9	26.1	43.2
21-Jun-21 03:52:32 AM	0.12	457	0.03	0.9	26.3	43.3
21-Jun-21 03:53:33 AM	0.12	459	0.03	0.9	26.1	43.2
21-Jun-21 03:54:34 AM	0.12	461	0.04	0.9	26.1	43.2
21-Jun-21 03:55:35 AM	0.12	458	0.04	0.9	26.2	43.2
21-Jun-21 03:56:36 AM	0.12	461	0.04	0.9	26.1	43.1
21-Jun-21 03:57:37 AM	0.12	460	0.04	0.9	26.1	43.1
21-Jun-21 03:58:38 AM	0.12	459	0.04	0.9	26.0	43.1
21-Jun-21 03:59:39 AM	0.12	459	0.04	0.9	26.3	43.2
21-Jun-21 04:00:40 AM	0.12	458	0.04	0.9	26.3	43.2
21-Jun-21 04:01:41 AM	0.12	459	0.04	0.9	26.3	43.1
21-Jun-21 04:02:42 AM	0.12	459	0.04	0.9	26.3	43.1
21-Jun-21 04:03:43 AM	0.12	459	0.03	0.9	26.4	43.1
21-Jun-21 04:04:44 AM	0.12	461	0.04	0.9	26.2	42.9
21-Jun-21 04:05:45 AM	0.12	460	0.04	1.0	26.2	42.9
21-Jun-21 04:06:46 AM	0.12	457	0.04	0.9	26.4	43.0
21-Jun-21 04:07:47 AM	0.12	460	0.04	1.0	26.1	42.9
21-Jun-21 04:08:48 AM	0.12	459	0.04	0.9	26.1	42.9
21-Jun-21 04:09:49 AM	0.12	457	0.04	0.9	26.2	42.9
21-Jun-21 04:10:50 AM	0.12	457	0.04	0.9	25.9	42.9
21-Jun-21 04:11:51 AM	0.12	459	0.04	0.9	26.2	43.0
21-Jun-21 04:12:52 AM	0.12	459	0.04	0.9	26.0	43.0
21-Jun-21 04:13:53 AM	0.12	461	0.04	0.9	26.1	42.9
21-Jun-21 04:14:54 AM	0.12	459	0.04	0.9	26.1	43.0
21-Jun-21 04:15:55 AM	0.12	458	0.04	0.9	26.0	43.0
21-Jun-21 04:16:56 AM	0.12	458	0.04	0.9	26.1	43.0
21-Jun-21 04:17:57 AM	0.12	457	0.04	0.9	26.1	43.0
21-Jun-21 04:18:58 AM	0.12	458	0.04	0.9	26.3	43.1
21-Jun-21 04:19:59 AM	0.12	457	0.04	0.9	26.2	43.1
21-Jun-21 04:21:00 AM	0.12	457	0.04	0.9	26.2	43.1
21-Jun-21 04:22:01 AM	0.12	457	0.04	0.9	26.0	43.0
21-Jun-21 04:23:02 AM	0.12	459	0.04	0.9	25.9	43.0
21-Jun-21 04:24:03 AM	0.12	459	0.04	0.9	26.0	43.0
21-Jun-21 04:25:04 AM	0.12	457	0.04	0.9	26.1	43.0
21-Jun-21 04:26:05 AM	0.12	456	0.04	0.9	26.1	43.0
21-Jun-21 04:27:06 AM	0.12	456	0.04	0.9	26.1	43.0
21-Jun-21 04:28:07 AM	0.12	456	0.04	0.9	26.1	43.0
21-Jun-21 04:29:08 AM	0.12	459	0.04	0.9	26.1	42.9
21-Jun-21 04:30:09 AM	0.12	457	0.04	0.9	26.1	42.9
21-Jun-21 04:31:10 AM	0.12	458	0.04	0.9	26.0	42.9
21-Jun-21 04:32:11 AM	0.12	459	0.04	0.9	25.9	42.8
21-Jun-21 04:33:12 AM	0.12	458	0.04	0.9	26.0	42.8
21-Jun-21 04:34:13 AM	0.12	456	0.04	0.9	26.1	42.9

21-Jun-21 04:35:14 AM	0.12	456	0.03	0.9	26.1	43.0
21-Jun-21 04:36:15 AM	0.12	457	0.04	0.9	25.9	42.9
21-Jun-21 04:37:16 AM	0.12	456	0.04	0.9	26.0	43.0
21-Jun-21 04:38:17 AM	0.12	454	0.03	0.9	26.1	43.0
21-Jun-21 04:39:18 AM	0.12	455	0.04	0.9	26.1	43.0
21-Jun-21 04:40:19 AM	0.12	457	0.03	0.9	26.1	43.1
21-Jun-21 04:41:20 AM	0.12	459	0.04	0.9	26.0	43.1
21-Jun-21 04:42:21 AM	0.12	456	0.04	0.9	26.0	43.1
21-Jun-21 04:43:22 AM	0.12	456	0.04	0.9	26.0	43.0
21-Jun-21 04:44:23 AM	0.12	455	0.04	0.9	25.9	43.0
21-Jun-21 04:45:24 AM	0.12	456	0.04	0.9	25.9	43.0
21-Jun-21 04:46:25 AM	0.12	459	0.03	0.9	26.0	43.0
21-Jun-21 04:47:26 AM	0.12	456	0.03	0.9	26.1	43.1
21-Jun-21 04:48:27 AM	0.12	456	0.03	0.9	25.9	43.0
21-Jun-21 04:49:28 AM	0.12	456	0.03	0.9	25.9	43.0
21-Jun-21 04:50:29 AM	0.12	454	0.03	0.9	26.0	43.0
21-Jun-21 04:51:30 AM	0.12	455	0.03	0.9	25.8	42.9
21-Jun-21 04:52:31 AM	0.12	458	0.03	0.9	25.9	43.0
21-Jun-21 04:53:32 AM	0.12	457	0.03	0.9	25.9	43.0
21-Jun-21 04:54:33 AM	0.12	457	0.03	0.9	25.8	43.0
21-Jun-21 04:55:34 AM	0.12	455	0.03	0.9	25.8	42.9
21-Jun-21 04:56:35 AM	0.12	456	0.03	0.8	25.9	43.0
21-Jun-21 04:57:36 AM	0.12	456	0.03	0.9	25.9	43.0
21-Jun-21 04:58:37 AM	0.12	456	0.03	0.8	25.9	42.9
21-Jun-21 04:59:38 AM	0.12	455	0.03	0.9	26.0	43.0
21-Jun-21 05:00:39 AM	0.12	455	0.03	0.9	25.8	42.9
21-Jun-21 05:01:40 AM	0.12	454	0.03	0.9	26.1	42.9
21-Jun-21 05:02:41 AM	0.12	457	0.03	0.9	25.9	42.9
21-Jun-21 05:03:42 AM	0.12	457	0.03	0.9	25.9	42.8
21-Jun-21 05:04:43 AM	0.12	455	0.03	0.9	25.9	42.8
21-Jun-21 05:05:44 AM	0.12	457	0.03	0.8	25.9	42.8
21-Jun-21 05:06:45 AM	0.12	457	0.03	0.8	25.8	42.7
21-Jun-21 05:07:46 AM	0.12	455	0.03	0.9	25.9	42.8
21-Jun-21 05:08:47 AM	0.12	457	0.03	0.9	25.9	42.8
21-Jun-21 05:09:48 AM	0.12	455	0.03	0.9	25.9	42.8
21-Jun-21 05:10:49 AM	0.12	456	0.03	0.9	25.8	42.7
21-Jun-21 05:11:50 AM	0.12	454	0.03	0.9	25.8	42.7
21-Jun-21 05:12:51 AM	0.12	455	0.03	0.8	25.7	42.7
21-Jun-21 05:13:52 AM	0.12	457	0.03	0.8	25.8	42.7
21-Jun-21 05:14:53 AM	0.12	456	0.03	0.8	25.8	42.7
21-Jun-21 05:15:54 AM	0.12	457	0.03	0.9	25.8	42.7
21-Jun-21 05:16:55 AM	0.12	454	0.03	0.9	25.8	42.7
21-Jun-21 05:17:56 AM	0.12	455	0.03	0.9	26.0	42.7
21-Jun-21 05:18:57 AM	0.12	456	0.03	0.9	25.9	42.7
21-Jun-21 05:19:58 AM	0.12	456	0.03	0.9	25.7	42.7
21-Jun-21 05:20:59 AM	0.12	457	0.03	0.9	25.8	42.7
21-Jun-21 05:22:00 AM	0.12	456	0.03	0.9	25.8	42.7
21-Jun-21 05:23:01 AM	0.12	455	0.03	0.9	25.9	42.8
21-Jun-21 05:24:02 AM	0.12	454	0.03	0.9	26.2	43.0
21-Jun-21 05:25:03 AM	0.12	454	0.03	0.9	26.0	42.9
21-Jun-21 05:26:04 AM	0.12	456	0.03	0.9	26.0	42.8
21-Jun-21 05:27:05 AM	0.12	452	0.03	0.9	25.9	42.7
21-Jun-21 05:28:06 AM	0.12	454	0.03	0.9	26.1	42.8
21-Jun-21 05:29:07 AM	0.12	456	0.03	0.9	25.9	42.7
21-Jun-21 05:30:08 AM	0.12	455	0.03	0.9	26.0	42.7
21-Jun-21 05:31:09 AM	0.12	456	0.03	0.9	25.9	42.7
21-Jun-21 05:32:10 AM	0.12	454	0.03	0.9	26.0	42.7

21-Jun-21 05:33:11 AM	0.12	457	0.03	0.9	25.9	42.6
21-Jun-21 05:34:12 AM	0.12	457	0.03	0.9	26.0	42.6
21-Jun-21 05:35:13 AM	0.12	456	0.03	0.9	26.0	42.6
21-Jun-21 05:36:14 AM	0.12	455	0.03	0.9	25.9	42.5
21-Jun-21 05:37:15 AM	0.12	454	0.03	0.9	25.9	42.5
21-Jun-21 05:38:16 AM	0.12	457	0.03	0.9	25.8	42.5
21-Jun-21 05:39:17 AM	0.12	454	0.03	0.9	26.1	42.6
21-Jun-21 05:40:18 AM	0.12	456	0.03	0.9	26.1	42.6
21-Jun-21 05:41:19 AM	0.12	455	0.03	0.9	26.0	42.5
21-Jun-21 05:42:20 AM	0.12	455	0.03	0.9	26.1	42.5
21-Jun-21 05:43:21 AM	0.12	456	0.03	0.9	25.9	42.4
21-Jun-21 05:44:22 AM	0.12	454	0.03	0.9	26.0	42.4
21-Jun-21 05:45:23 AM	0.12	456	0.03	0.9	26.0	42.4
21-Jun-21 05:46:24 AM	0.12	455	0.03	0.9	26.1	42.4
21-Jun-21 05:47:25 AM	0.12	454	0.03	0.9	26.2	42.5
21-Jun-21 05:48:26 AM	0.12	452	0.03	0.9	26.3	42.5
21-Jun-21 05:49:27 AM	0.12	455	0.03	0.9	26.3	42.5
21-Jun-21 05:50:28 AM	0.12	454	0.03	0.9	26.3	42.5
21-Jun-21 05:51:29 AM	0.12	456	0.03	0.9	26.3	42.3
21-Jun-21 05:52:30 AM	0.12	454	0.03	0.9	26.5	42.4
21-Jun-21 05:53:31 AM	0.12	455	0.03	0.9	26.3	42.2
21-Jun-21 05:54:32 AM	0.12	456	0.03	1.0	26.2	42.0
21-Jun-21 05:55:33 AM	0.12	455	0.03	0.9	26.2	42.0
21-Jun-21 05:56:34 AM	0.12	456	0.03	0.9	26.3	41.9
21-Jun-21 05:57:35 AM	0.12	452	0.03	0.9	26.3	41.9
21-Jun-21 05:58:36 AM	0.12	451	0.03	0.9	26.3	41.9
21-Jun-21 05:59:37 AM	0.12	455	0.03	0.9	26.5	42.1
21-Jun-21 06:00:38 AM	0.12	459	0.03	0.9	26.2	42.0
21-Jun-21 06:01:39 AM	0.12	459	0.03	0.9	26.1	41.9
21-Jun-21 06:02:40 AM	0.12	456	0.03	0.9	26.4	41.9
21-Jun-21 06:03:41 AM	0.12	456	0.03	0.9	26.4	41.9
21-Jun-21 06:04:42 AM	0.12	455	0.03	0.9	26.4	42.0
21-Jun-21 06:05:43 AM	0.12	457	0.03	0.9	26.4	41.8
21-Jun-21 06:06:44 AM	0.12	454	0.03	0.9	26.4	41.9
21-Jun-21 06:07:45 AM	0.12	455	0.03	0.9	26.4	41.8
21-Jun-21 06:08:46 AM	0.12	457	0.03	0.9	26.4	41.9
21-Jun-21 06:09:47 AM	0.12	456	0.03	0.9	26.5	41.8
21-Jun-21 06:10:48 AM	0.12	456	0.03	0.9	26.5	41.8
21-Jun-21 06:11:49 AM	0.12	456	0.03	0.9	26.7	41.9
21-Jun-21 06:12:50 AM	0.12	457	0.03	0.9	26.5	41.7
21-Jun-21 06:13:51 AM	0.12	457	0.03	0.9	26.5	41.6
21-Jun-21 06:14:52 AM	0.12	454	0.03	0.9	26.7	41.6
21-Jun-21 06:15:53 AM	0.12	458	0.03	0.9	26.7	41.8
21-Jun-21 06:16:54 AM	0.12	457	0.03	1.0	26.7	41.5
21-Jun-21 06:17:55 AM	0.12	458	0.03	1.0	26.6	41.3
21-Jun-21 06:18:56 AM	0.12	457	0.03	0.9	26.9	41.6
21-Jun-21 06:19:57 AM	0.12	458	0.03	0.9	26.7	41.6
21-Jun-21 06:20:58 AM	0.12	457	0.03	1.0	26.7	41.4
21-Jun-21 06:21:59 AM	0.12	457	0.03	0.9	26.8	41.5
21-Jun-21 06:23:00 AM	0.11	459	0.03	1.0	26.7	41.2
21-Jun-21 06:24:01 AM	0.12	460	0.03	0.9	26.9	41.4
21-Jun-21 06:25:02 AM	0.12	459	0.03	0.9	26.9	41.4
21-Jun-21 06:26:03 AM	0.12	458	0.03	0.9	26.9	41.4
21-Jun-21 06:27:04 AM	0.12	458	0.03	0.9	27.0	41.5
21-Jun-21 06:28:05 AM	0.12	457	0.03	1.0	26.9	41.4
21-Jun-21 06:29:06 AM	0.12	457	0.03	1.0	27.1	41.4
21-Jun-21 06:30:07 AM	0.12	456	0.03	1.0	27.1	41.5

21-Jun-21 06:31:08 AM	0.11	458	0.03	1.0	27.1	41.4
21-Jun-21 06:32:09 AM	0.12	460	0.03	1.0	27.2	41.6
21-Jun-21 06:33:10 AM	0.12	460	0.03	1.0	27.2	41.5
21-Jun-21 06:34:11 AM	0.12	458	0.03	1.0	27.2	41.5
21-Jun-21 06:35:12 AM	0.11	460	0.03	1.0	27.1	41.2
21-Jun-21 06:36:13 AM	0.12	458	0.03	1.0	27.2	41.3
21-Jun-21 06:37:14 AM	0.12	460	0.03	1.0	27.2	41.2
21-Jun-21 06:38:15 AM	0.12	460	0.03	1.0	27.4	41.4
21-Jun-21 06:39:16 AM	0.12	457	0.03	1.0	27.3	41.3
21-Jun-21 06:40:17 AM	0.12	460	0.03	1.0	27.3	41.2
21-Jun-21 06:41:18 AM	0.11	459	0.03	1.0	27.2	41.0
21-Jun-21 06:42:19 AM	0.12	460	0.03	1.0	27.4	41.3
21-Jun-21 06:43:20 AM	0.12	461	0.03	1.0	27.2	41.2
21-Jun-21 06:44:21 AM	0.12	459	0.03	1.0	27.4	41.1
21-Jun-21 06:45:22 AM	0.12	460	0.03	1.0	27.4	41.3
21-Jun-21 06:46:23 AM	0.12	461	0.03	1.0	27.4	41.3
21-Jun-21 06:47:24 AM	0.12	460	0.03	1.0	27.4	41.2
21-Jun-21 06:48:25 AM	0.12	460	0.03	1.0	27.5	41.2
21-Jun-21 06:49:26 AM	0.12	460	0.03	1.0	27.5	41.1
21-Jun-21 06:50:27 AM	0.12	461	0.03	1.0	27.5	41.0
21-Jun-21 06:51:28 AM	0.12	460	0.03	1.0	27.6	41.1
21-Jun-21 06:52:29 AM	0.12	464	0.03	1.0	27.5	41.0
21-Jun-21 06:53:30 AM	0.12	463	0.03	1.0	27.6	41.1
21-Jun-21 06:54:31 AM	0.12	461	0.03	1.0	27.6	41.0
21-Jun-21 06:55:32 AM	0.12	462	0.03	1.0	27.6	40.9
21-Jun-21 06:56:33 AM	0.12	459	0.03	1.0	27.6	40.9
21-Jun-21 06:57:34 AM	0.12	462	0.03	1.0	27.7	40.9
21-Jun-21 06:58:35 AM	0.12	462	0.03	1.0	27.7	40.9
21-Jun-21 06:59:36 AM	0.12	461	0.03	1.0	27.7	40.9
21-Jun-21 07:00:37 AM	0.12	464	0.03	1.0	27.7	40.7
21-Jun-21 07:01:38 AM	0.12	465	0.03	1.0	27.7	40.6
21-Jun-21 07:02:39 AM	0.12	462	0.03	1.0	27.7	40.7
21-Jun-21 07:03:40 AM	0.12	464	0.03	1.0	27.7	40.7
21-Jun-21 07:04:41 AM	0.12	463	0.03	1.0	27.7	40.6
21-Jun-21 07:05:42 AM	0.12	464	0.03	1.0	27.7	40.6
21-Jun-21 07:06:43 AM	0.12	463	0.03	1.0	27.8	40.7
21-Jun-21 07:07:44 AM	0.12	463	0.03	1.0	27.8	40.7
21-Jun-21 07:08:45 AM	0.12	463	0.03	1.0	27.8	40.6
21-Jun-21 07:09:46 AM	0.12	463	0.02	1.0	27.8	40.8
21-Jun-21 07:10:47 AM	0.12	465	0.02	1.0	27.9	40.6
21-Jun-21 07:11:48 AM	0.12	464	0.02	1.0	27.9	40.6
21-Jun-21 07:12:49 AM	0.12	464	0.02	1.0	28.0	40.7
21-Jun-21 07:13:50 AM	0.12	465	0.03	1.0	27.9	40.5
21-Jun-21 07:14:51 AM	0.12	464	0.02	1.0	27.9	40.4
21-Jun-21 07:15:52 AM	0.12	466	0.03	1.0	27.9	40.4
21-Jun-21 07:16:53 AM	0.12	465	0.03	1.0	28.0	40.5
21-Jun-21 07:17:54 AM	0.12	466	0.02	1.0	28.0	40.6
21-Jun-21 07:18:55 AM	0.12	464	0.02	1.0	28.0	40.5
21-Jun-21 07:19:56 AM	0.12	465	0.02	1.0	28.0	40.4
21-Jun-21 07:20:57 AM	0.12	464	0.02	1.0	28.0	40.2
21-Jun-21 07:21:58 AM	0.12	465	0.03	1.0	28.0	40.3
21-Jun-21 07:22:59 AM	0.12	466	0.02	1.0	28.0	40.3
21-Jun-21 07:24:00 AM	0.12	466	0.02	1.0	28.0	40.3
21-Jun-21 07:25:01 AM	0.12	466	0.03	1.0	28.0	40.3
21-Jun-21 07:26:02 AM	0.12	467	0.03	1.0	28.0	40.2
21-Jun-21 07:27:03 AM	0.12	466	0.03	1.0	28.1	40.3
21-Jun-21 07:28:04 AM	0.12	467	0.03	1.0	28.0	40.1

21-Jun-21 07:29:05 AM	0.12	466	0.03	1.0	28.0	40.1
21-Jun-21 07:30:06 AM	0.12	467	0.03	0.9	28.1	40.2
21-Jun-21 07:31:07 AM	0.12	467	0.02	1.0	28.0	40.1
21-Jun-21 07:32:08 AM	0.11	468	0.02	0.9	28.1	40.1
21-Jun-21 07:33:09 AM	0.12	467	0.03	0.9	28.1	40.1
21-Jun-21 07:34:10 AM	0.12	467	0.02	0.9	28.1	40.2
21-Jun-21 07:35:11 AM	0.12	466	0.02	0.9	28.1	40.2
21-Jun-21 07:36:12 AM	0.12	469	0.02	1.0	28.1	40.3
21-Jun-21 07:37:13 AM	0.11	467	0.03	0.9	28.2	40.2
21-Jun-21 07:38:14 AM	0.12	466	0.02	0.9	28.2	40.2
21-Jun-21 07:39:15 AM	0.12	468	0.02	0.9	28.2	40.1
21-Jun-21 07:40:16 AM	0.12	468	0.02	0.9	28.2	40.1
21-Jun-21 07:41:17 AM	0.12	468	0.02	1.0	28.2	40.1
21-Jun-21 07:42:18 AM	0.12	469	0.02	1.0	28.2	40.1
21-Jun-21 07:43:19 AM	0.11	469	0.02	0.9	28.2	40.0
21-Jun-21 07:44:20 AM	0.12	467	0.02	0.9	28.3	40.1
21-Jun-21 07:45:21 AM	0.12	469	0.02	1.0	28.3	40.1
21-Jun-21 07:46:22 AM	0.12	469	0.02	1.0	28.3	40.0
21-Jun-21 07:47:23 AM	0.12	468	0.02	1.0	28.2	40.0
21-Jun-21 07:48:24 AM	0.12	467	0.02	1.0	28.2	39.9
21-Jun-21 07:49:25 AM	0.12	469	0.02	1.0	28.2	39.8
21-Jun-21 07:50:26 AM	0.12	466	0.03	0.9	28.2	39.8
21-Jun-21 07:51:27 AM	0.12	468	0.03	1.0	28.2	39.7
21-Jun-21 07:52:28 AM	0.12	469	0.02	0.9	28.2	39.9
21-Jun-21 07:53:29 AM	0.12	467	0.02	0.9	28.3	39.9
21-Jun-21 07:54:30 AM	0.12	469	0.02	0.9	28.2	39.8
21-Jun-21 07:55:31 AM	0.12	469	0.02	0.9	28.2	39.7
21-Jun-21 07:56:32 AM	0.12	469	0.03	0.9	28.2	39.6
21-Jun-21 07:57:33 AM	0.12	469	0.02	0.9	28.2	39.8
21-Jun-21 07:58:34 AM	0.12	468	0.02	0.9	28.2	39.8
21-Jun-21 07:59:35 AM	0.12	468	0.03	0.9	28.2	39.9
21-Jun-21 08:00:36 AM	0.12	470	0.03	0.9	28.2	39.7
21-Jun-21 08:01:37 AM	0.12	471	0.02	0.9	28.2	39.7
21-Jun-21 08:02:38 AM	0.12	469	0.02	0.9	28.3	39.7
21-Jun-21 08:03:39 AM	0.12	469	0.02	0.9	28.3	39.8
21-Jun-21 08:04:40 AM	0.12	471	0.02	0.9	28.3	39.7
21-Jun-21 08:05:41 AM	0.12	470	0.02	0.9	28.3	39.7
21-Jun-21 08:06:42 AM	0.12	470	0.03	0.9	28.3	39.6
21-Jun-21 08:07:43 AM	0.12	468	0.03	0.9	28.3	39.6
21-Jun-21 08:08:44 AM	0.12	468	0.03	0.9	28.3	39.7
21-Jun-21 08:09:45 AM	0.12	469	0.03	0.9	28.3	39.8
21-Jun-21 08:10:46 AM	0.12	469	0.02	0.9	28.3	39.7
21-Jun-21 08:11:47 AM	0.12	468	0.03	0.9	28.3	39.7
21-Jun-21 08:12:48 AM	0.12	470	0.03	0.9	28.3	39.6
21-Jun-21 08:13:49 AM	0.12	469	0.03	0.9	28.4	39.7
21-Jun-21 08:14:50 AM	0.12	466	0.03	0.9	28.4	39.7
21-Jun-21 08:15:51 AM	0.12	469	0.03	0.9	28.4	39.6
21-Jun-21 08:16:52 AM	0.12	470	0.03	0.9	28.3	39.6
21-Jun-21 08:17:53 AM	0.12	470	0.03	0.9	28.4	39.5
21-Jun-21 08:18:54 AM	0.12	467	0.03	0.9	28.4	39.7
21-Jun-21 08:19:55 AM	0.12	468	0.03	0.9	28.4	39.6
21-Jun-21 08:20:56 AM	0.12	469	0.03	0.9	28.4	39.4
21-Jun-21 08:21:57 AM	0.12	468	0.03	0.9	28.4	39.5
21-Jun-21 08:22:58 AM	0.12	469	0.03	0.9	28.4	39.5
21-Jun-21 08:23:59 AM	0.12	467	0.03	0.9	28.4	39.6
21-Jun-21 08:25:00 AM	0.12	466	0.03	0.9	28.4	39.7
21-Jun-21 08:26:01 AM	0.12	469	0.03	0.9	28.4	39.7

21-Jun-21 08:27:02 AM	0.12	468	0.03	0.9	28.4	39.7
21-Jun-21 08:28:03 AM	0.12	469	0.03	0.9	28.4	39.7
21-Jun-21 08:29:04 AM	0.12	469	0.03	0.9	28.4	39.7
21-Jun-21 08:30:05 AM	0.12	471	0.03	0.9	28.4	39.6
21-Jun-21 08:31:06 AM	0.12	467	0.03	0.9	28.5	39.5
21-Jun-21 08:32:07 AM	0.12	469	0.03	0.9	28.4	39.7
21-Jun-21 08:33:08 AM	0.12	470	0.02	0.9	28.4	39.8
21-Jun-21 08:34:09 AM	0.12	468	0.03	0.9	28.3	39.5
21-Jun-21 08:35:10 AM	0.12	469	0.03	0.9	28.3	39.6
21-Jun-21 08:36:11 AM	0.12	471	0.03	0.9	28.4	39.5
21-Jun-21 08:37:12 AM	0.12	469	0.02	0.9	28.4	39.7
21-Jun-21 08:38:13 AM	0.12	468	0.02	0.9	28.5	39.8
21-Jun-21 08:39:14 AM	0.12	468	0.02	0.9	28.5	39.8
21-Jun-21 08:40:15 AM	0.12	471	0.02	0.9	28.5	39.6
21-Jun-21 08:41:16 AM	0.12	469	0.02	0.9	28.5	39.6
21-Jun-21 08:42:17 AM	0.12	470	0.02	0.9	28.5	39.6
21-Jun-21 08:43:18 AM	0.12	470	0.03	0.9	28.4	39.5
21-Jun-21 08:44:19 AM	0.12	469	0.02	0.9	28.5	39.6
21-Jun-21 08:45:20 AM	0.12	471	0.02	0.9	28.4	39.6
21-Jun-21 08:46:21 AM	0.12	470	0.02	0.9	28.5	39.8
21-Jun-21 08:47:22 AM	0.12	472	0.02	0.9	28.5	39.6
21-Jun-21 08:48:23 AM	0.12	470	0.03	0.9	28.5	39.5
21-Jun-21 08:49:24 AM	0.12	470	0.02	0.9	28.5	39.4
21-Jun-21 08:50:25 AM	0.12	470	0.02	0.9	28.5	39.6
21-Jun-21 08:51:26 AM	0.12	471	0.02	0.9	28.4	39.5
21-Jun-21 08:52:27 AM	0.12	466	0.03	0.9	28.5	39.4
21-Jun-21 08:53:28 AM	0.12	469	0.03	0.9	28.5	39.7
21-Jun-21 08:54:29 AM	0.12	471	0.02	0.9	28.5	39.7
21-Jun-21 08:55:30 AM	0.12	470	0.02	0.9	28.5	39.6
21-Jun-21 08:56:31 AM	0.12	470	0.02	0.9	28.5	39.6
21-Jun-21 08:57:32 AM	0.12	468	0.02	0.9	28.6	39.8
21-Jun-21 08:58:33 AM	0.12	469	0.02	0.9	28.5	39.6
21-Jun-21 08:59:34 AM	0.12	470	0.02	0.9	28.6	39.6
21-Jun-21 09:00:35 AM	0.12	470	0.02	0.9	28.6	39.7
21-Jun-21 09:01:36 AM	0.12	469	0.02	0.9	28.6	39.6
21-Jun-21 09:02:37 AM	0.12	471	0.02	0.9	28.6	39.6
21-Jun-21 09:03:38 AM	0.12	470	0.02	0.9	28.5	39.6
21-Jun-21 09:04:39 AM	0.12	469	0.02	0.9	28.6	39.6
21-Jun-21 09:05:40 AM	0.12	470	0.02	0.9	28.6	39.6
21-Jun-21 09:06:41 AM	0.12	470	0.02	0.9	28.6	39.6
21-Jun-21 09:07:42 AM	0.12	470	0.03	0.9	28.6	39.4
21-Jun-21 09:08:43 AM	0.12	469	0.02	0.9	28.6	39.6
21-Jun-21 09:09:44 AM	0.12	468	0.02	0.9	28.5	39.6
21-Jun-21 09:10:45 AM	0.12	470	0.02	0.9	28.6	39.5
21-Jun-21 09:11:46 AM	0.12	470	0.02	0.9	28.6	39.7
21-Jun-21 09:12:47 AM	0.12	469	0.02	0.9	28.6	39.7
21-Jun-21 09:13:48 AM	0.12	469	0.02	0.9	28.6	39.7
21-Jun-21 09:14:49 AM	0.12	469	0.02	0.9	28.6	39.8
21-Jun-21 09:15:50 AM	0.12	469	0.02	0.8	28.5	39.7
21-Jun-21 09:16:51 AM	0.12	470	0.02	0.9	28.5	39.7
21-Jun-21 09:17:52 AM	0.12	469	0.02	0.8	28.6	39.7
21-Jun-21 09:18:53 AM	0.12	470	0.02	0.9	28.6	39.8
21-Jun-21 09:19:54 AM	0.12	471	0.02	0.9	28.5	39.7
21-Jun-21 09:20:55 AM	0.12	470	0.02	0.8	28.6	39.8
21-Jun-21 09:21:56 AM	0.12	470	0.02	0.9	28.6	39.8
21-Jun-21 09:22:57 AM	0.12	470	0.02	0.9	28.6	39.8
21-Jun-21 09:23:58 AM	0.12	470	0.02	0.9	28.6	39.8

21-Jun-21 09:24:59 AM	0.12	470	0.02	0.9	28.6	39.8
21-Jun-21 09:26:00 AM	0.12	471	0.02	0.9	28.6	39.8
21-Jun-21 09:27:01 AM	0.12	471	0.02	0.9	28.6	39.7
21-Jun-21 09:28:02 AM	0.12	471	0.02	0.9	28.6	39.7
21-Jun-21 09:29:03 AM	0.12	470	0.02	0.9	28.6	39.7
21-Jun-21 09:30:04 AM	0.12	470	0.03	0.9	28.6	39.7
21-Jun-21 09:31:05 AM	0.12	468	0.03	0.9	28.7	39.8
21-Jun-21 09:32:06 AM	0.12	470	0.02	0.9	28.6	39.8
21-Jun-21 09:33:07 AM	0.12	471	0.02	0.9	28.6	39.8
21-Jun-21 09:34:08 AM	0.12	471	0.02	0.8	28.6	39.8
21-Jun-21 09:35:09 AM	0.12	469	0.02	0.8	28.7	39.8
21-Jun-21 09:36:10 AM	0.12	472	0.02	0.8	28.7	39.8
21-Jun-21 09:37:11 AM	0.12	471	0.02	0.8	28.6	39.8
21-Jun-21 09:38:12 AM	0.12	470	0.02	0.8	28.7	39.8
21-Jun-21 09:39:13 AM	0.12	470	0.02	0.8	28.7	39.9
21-Jun-21 09:40:14 AM	0.12	471	0.02	0.8	28.6	39.8
21-Jun-21 09:41:15 AM	0.12	473	0.02	0.8	28.7	39.8
21-Jun-21 09:42:16 AM	0.12	473	0.02	0.8	28.7	39.9
21-Jun-21 09:43:17 AM	0.12	473	0.02	0.8	28.7	39.9
21-Jun-21 09:44:18 AM	0.12	472	0.02	0.8	28.7	39.9
21-Jun-21 09:45:19 AM	0.12	472	0.02	0.8	28.7	39.9
21-Jun-21 09:46:20 AM	0.12	472	0.02	0.8	28.8	39.9
21-Jun-21 09:47:21 AM	0.12	473	0.02	0.8	28.8	39.9
21-Jun-21 09:48:22 AM	0.12	474	0.02	0.8	28.7	39.8
21-Jun-21 09:49:23 AM	0.12	475	0.02	0.9	28.7	39.8
21-Jun-21 09:50:24 AM	0.13	475	0.02	0.8	28.8	39.8
21-Jun-21 09:51:25 AM	0.12	475	0.02	0.8	28.7	39.9
21-Jun-21 09:52:26 AM	0.12	477	0.02	0.9	28.7	39.8
21-Jun-21 09:53:27 AM	0.13	474	0.02	0.8	28.8	39.9
21-Jun-21 09:54:28 AM	0.12	475	0.02	0.8	28.8	39.9
21-Jun-21 09:55:29 AM	0.12	475	0.02	0.8	28.7	39.8
21-Jun-21 09:56:30 AM	0.13	476	0.02	0.8	28.8	39.9
21-Jun-21 09:57:31 AM	0.13	477	0.02	0.8	28.8	39.9
21-Jun-21 09:58:32 AM	0.13	475	0.02	0.8	28.7	39.9
21-Jun-21 09:59:33 AM	0.13	479	0.02	0.8	28.8	40.0
21-Jun-21 10:00:34 AM	0.13	478	0.02	0.8	28.7	39.9
21-Jun-21 10:01:35 AM	0.13	477	0.02	0.8	28.7	39.8
21-Jun-21 10:02:36 AM	0.13	478	0.02	0.8	28.8	39.9
21-Jun-21 10:03:37 AM	0.13	476	0.02	0.8	28.8	40.0
21-Jun-21 10:04:38 AM	0.13	478	0.02	0.8	28.8	40.0
21-Jun-21 10:05:39 AM	0.13	477	0.02	0.8	28.8	40.0
21-Jun-21 10:06:40 AM	0.13	478	0.02	0.8	28.8	39.9
21-Jun-21 10:07:41 AM	0.13	477	0.02	0.8	28.8	40.0
21-Jun-21 10:08:42 AM	0.13	479	0.02	0.8	28.8	40.0
21-Jun-21 10:09:43 AM	0.12	479	0.02	0.8	28.8	39.9
21-Jun-21 10:10:44 AM	0.13	479	0.02	0.8	28.8	39.9
21-Jun-21 10:11:45 AM	0.13	480	0.02	0.8	28.8	39.9
21-Jun-21 10:12:46 AM	0.13	479	0.02	0.8	28.8	39.9
21-Jun-21 10:13:47 AM	0.13	480	0.02	0.8	28.8	39.9
21-Jun-21 10:14:48 AM	0.13	480	0.02	0.8	28.8	40.0
21-Jun-21 10:15:49 AM	0.13	479	0.02	0.8	28.8	40.0
21-Jun-21 10:16:50 AM	0.13	482	0.02	0.8	28.8	39.9
21-Jun-21 10:17:51 AM	0.13	481	0.02	0.8	28.8	39.9
21-Jun-21 10:18:52 AM	0.13	478	0.02	0.8	28.8	40.0
21-Jun-21 10:19:53 AM	0.13	478	0.02	0.8	28.8	39.9
21-Jun-21 10:20:54 AM	0.13	482	0.02	0.8	28.7	39.9
21-Jun-21 10:21:55 AM	0.13	480	0.02	0.8	28.7	39.9

21-Jun-21 10:22:56 AM	0.13	480	0.02	0.8	28.8	39.9
21-Jun-21 10:23:57 AM	0.13	480	0.02	0.8	28.8	40.0
21-Jun-21 10:24:58 AM	0.13	480	0.02	0.8	28.8	40.0
21-Jun-21 10:25:59 AM	0.13	481	0.02	0.8	28.8	39.9
21-Jun-21 10:27:00 AM	0.13	479	0.02	0.8	28.8	40.0
21-Jun-21 10:28:01 AM	0.13	480	0.02	0.8	28.8	39.9
21-Jun-21 10:29:02 AM	0.13	481	0.02	0.8	28.8	39.9
21-Jun-21 10:30:03 AM	0.13	481	0.02	0.8	28.8	40.0
21-Jun-21 10:31:04 AM	0.13	481	0.02	0.8	28.8	40.0
21-Jun-21 10:32:05 AM	0.13	480	0.02	0.8	28.8	40.0
21-Jun-21 10:33:06 AM	0.13	480	0.02	0.8	28.8	40.0
21-Jun-21 10:34:07 AM	0.13	482	0.02	0.8	28.8	39.9
21-Jun-21 10:35:08 AM	0.13	482	0.02	0.8	28.8	39.9
21-Jun-21 10:36:09 AM	0.13	482	0.02	0.8	28.8	40.0
21-Jun-21 10:37:10 AM	0.13	483	0.02	0.8	28.8	40.0
21-Jun-21 10:38:11 AM	0.13	481	0.02	0.8	28.9	40.0
21-Jun-21 10:39:12 AM	0.13	482	0.02	0.8	28.8	39.9
21-Jun-21 10:40:13 AM	0.13	480	0.02	0.8	28.8	39.9
21-Jun-21 10:41:14 AM	0.13	481	0.02	0.8	28.8	39.9
21-Jun-21 10:42:15 AM	0.13	480	0.02	0.8	28.7	39.9
21-Jun-21 10:43:16 AM	0.13	483	0.02	0.8	28.8	39.9
21-Jun-21 10:44:17 AM	0.13	481	0.02	0.8	28.8	40.0
21-Jun-21 10:45:18 AM	0.13	481	0.02	0.8	28.8	39.9
21-Jun-21 10:46:19 AM	0.13	480	0.02	0.8	28.8	40.0
21-Jun-21 10:47:20 AM	0.13	483	0.02	0.8	28.8	40.0
21-Jun-21 10:48:21 AM	0.13	482	0.02	0.8	28.8	40.0
21-Jun-21 10:49:22 AM	0.13	480	0.02	0.8	28.7	40.0
21-Jun-21 10:50:23 AM	0.13	482	0.02	0.8	28.7	39.9
21-Jun-21 10:51:24 AM	0.13	483	0.02	0.8	28.8	40.0
21-Jun-21 10:52:25 AM	0.13	484	0.02	0.8	28.7	40.0
21-Jun-21 10:53:26 AM	0.13	485	0.02	0.8	28.7	40.1
21-Jun-21 10:54:27 AM	0.13	508	0.02	0.8	28.5	40.2
21-Jun-21 10:55:28 AM	0.13	544	0.03	0.8	28.3	40.5
21-Jun-21 10:56:29 AM	0.13	597	0.03	0.8	28.3	41.2
21-Jun-21 10:57:30 AM	0.13	571	0.02	0.7	28.6	40.8
21-Jun-21 10:58:31 AM	0.19	552	0.02	0.7	28.7	40.7
21-Jun-21 10:59:32 AM	0.26	558	0.02	0.7	28.7	40.8
21-Jun-21 11:00:33 AM	0.21	548	0.02	0.8	28.6	40.7
21-Jun-21 11:01:34 AM	0.20	548	0.02	0.8	28.6	40.7
21-Jun-21 11:02:35 AM	0.17	533	0.02	0.8	28.7	40.6
21-Jun-21 11:03:36 AM	0.16	527	0.02	0.8	28.6	40.6
21-Jun-21 11:04:37 AM	0.15	519	0.02	0.8	28.7	40.6
21-Jun-21 11:05:38 AM	0.15	525	0.02	0.8	28.7	40.6
21-Jun-21 11:06:39 AM	0.15	533	0.03	0.8	28.6	40.7
21-Jun-21 11:07:40 AM	0.15	530	0.02	0.8	28.6	40.7
21-Jun-21 11:08:41 AM	0.14	529	0.02	0.8	28.7	40.8
21-Jun-21 11:09:42 AM	0.14	523	0.02	0.8	28.8	40.8
21-Jun-21 11:10:43 AM	0.14	519	0.02	0.8	28.7	40.8
21-Jun-21 11:11:44 AM	0.14	519	0.02	0.8	28.7	40.7
21-Jun-21 11:12:45 AM	0.14	525	0.03	0.8	28.7	40.9
21-Jun-21 11:13:46 AM	0.14	522	0.02	0.8	28.8	40.9
21-Jun-21 11:14:47 AM	0.14	522	0.02	0.8	28.7	40.9
21-Jun-21 11:15:48 AM	0.14	525	0.02	0.8	28.7	41.0
21-Jun-21 11:16:49 AM	0.14	519	0.02	0.8	28.7	40.8
21-Jun-21 11:17:50 AM	0.14	528	0.03	0.8	28.8	40.9
21-Jun-21 11:18:51 AM	0.14	566	0.03	0.8	28.7	41.5
21-Jun-21 11:19:52 AM	0.14	557	0.03	0.8	28.7	41.4

21-Jun-21 11:20:53 AM	0.14	550	0.03	0.8	28.7	41.4
21-Jun-21 11:21:54 AM	0.14	548	0.03	0.8	28.7	41.4
21-Jun-21 11:22:55 AM	0.14	543	0.03	0.7	28.8	41.4
21-Jun-21 11:23:56 AM	0.14	544	0.03	0.8	28.7	41.5
21-Jun-21 11:24:57 AM	0.14	543	0.03	0.7	28.7	41.5
21-Jun-21 11:25:58 AM	0.14	544	0.02	0.7	28.8	41.5
21-Jun-21 11:26:59 AM	0.14	544	0.03	0.7	28.7	41.5
21-Jun-21 11:28:00 AM	0.14	546	0.03	0.7	28.7	41.5
21-Jun-21 11:29:01 AM	0.14	543	0.03	0.8	28.7	41.4
21-Jun-21 11:30:02 AM	0.14	542	0.03	0.8	28.7	41.4
21-Jun-21 11:31:03 AM	0.14	538	0.02	0.8	28.8	41.4
21-Jun-21 11:32:04 AM	0.14	535	0.02	0.7	28.8	41.3
21-Jun-21 11:33:05 AM	0.14	543	0.03	0.7	28.7	41.4
21-Jun-21 11:34:06 AM	0.14	542	0.02	0.7	28.8	41.4
21-Jun-21 11:35:07 AM	0.14	541	0.03	0.8	28.8	41.3
21-Jun-21 11:36:08 AM	0.14	540	0.02	0.7	28.8	41.3
21-Jun-21 11:37:09 AM	0.14	537	0.03	0.7	28.7	41.3
21-Jun-21 11:38:10 AM	0.14	539	0.03	0.8	28.7	41.4
21-Jun-21 11:39:11 AM	0.14	535	0.02	0.8	28.8	41.3
21-Jun-21 11:40:12 AM	0.13	536	0.02	0.8	28.7	41.2
21-Jun-21 11:41:13 AM	0.13	536	0.02	0.8	28.8	41.3
21-Jun-21 11:42:14 AM	0.14	543	0.02	0.7	28.8	41.3
21-Jun-21 11:43:15 AM	0.14	547	0.02	0.7	28.8	41.3
21-Jun-21 11:44:16 AM	0.14	538	0.02	0.7	28.8	41.3
21-Jun-21 11:45:17 AM	0.13	543	0.03	0.8	28.8	41.3
21-Jun-21 11:46:18 AM	0.13	547	0.03	0.7	28.8	41.4
21-Jun-21 11:47:19 AM	0.13	547	0.03	0.7	28.8	41.4
21-Jun-21 11:48:20 AM	0.13	541	0.02	0.7	28.8	41.3
21-Jun-21 11:49:21 AM	0.13	542	0.02	0.7	28.8	41.3
21-Jun-21 11:50:22 AM	0.13	540	0.02	0.8	28.8	41.3
21-Jun-21 11:51:23 AM	0.14	540	0.02	0.7	28.8	41.3
21-Jun-21 11:52:24 AM	0.14	543	0.03	0.8	28.8	41.3
21-Jun-21 11:53:25 AM	0.14	544	0.03	0.8	28.8	41.4
21-Jun-21 11:54:26 AM	0.14	542	0.02	0.8	28.8	41.3
21-Jun-21 11:55:27 AM	0.14	540	0.02	0.7	28.9	41.3
21-Jun-21 11:56:28 AM	0.14	537	0.02	0.7	28.9	41.2
21-Jun-21 11:57:29 AM	0.14	544	0.03	0.8	28.8	41.4
21-Jun-21 11:58:30 AM	0.14	543	0.02	0.8	28.8	41.4
21-Jun-21 11:59:31 AM	0.14	545	0.02	0.8	28.8	41.4
21-Jun-21 12:00:32 PM	0.13	544	0.02	0.8	28.8	41.4
21-Jun-21 12:01:33 PM	0.14	541	0.02	0.8	28.9	41.3
21-Jun-21 12:02:34 PM	0.13	545	0.03	0.8	28.8	41.4
21-Jun-21 12:03:35 PM	0.13	542	0.03	0.8	28.7	41.5
21-Jun-21 12:04:36 PM	0.14	538	0.02	0.8	28.8	41.5
21-Jun-21 12:05:37 PM	0.14	541	0.02	0.8	28.7	41.4
21-Jun-21 12:06:38 PM	0.14	545	0.02	0.8	28.8	41.4
21-Jun-21 12:07:39 PM	0.14	541	0.03	0.8	28.8	41.4
21-Jun-21 12:08:40 PM	0.14	542	0.03	0.8	28.8	41.6
21-Jun-21 12:09:41 PM	0.14	533	0.02	0.8	28.9	41.3
Mean	0.12	482.99	0.03	0.95	27.46	41.61
Max	0.26	703.00	0.06	1.20	28.90	47.60
Min	0.11	451.00	0.01	0.70	25.70	39.40

Table S3: Concentrations of Indoor air pollutants in indoor space A during 24 hr.

Date Time	TVOC ppm	Carbon Dioxide ppm	Ozone ppm	Carbon Monoxide ppm	Temperature °C	Relative Humidity %RH
16-Jun-21 01:11:10 PM	0.13	748	0.03	1.5	29.0	29.6
16-Jun-21 01:12:11 PM	0.12	725	0.03	1.4	28.9	29.5
16-Jun-21 01:13:12 PM	0.12	727	0.03	1.3	28.8	29.5
16-Jun-21 01:14:13 PM	0.12	714	0.03	1.2	28.4	29.4
16-Jun-21 01:15:14 PM	0.12	705	0.03	1.2	28.1	29.3
16-Jun-21 01:16:15 PM	0.12	702	0.03	1.2	27.9	29.5
16-Jun-21 01:17:16 PM	0.11	702	0.03	1.1	27.8	29.7
16-Jun-21 01:18:17 PM	0.11	705	0.03	0.9	27.6	29.9
16-Jun-21 01:19:18 PM	0.11	702	0.03	0.8	27.6	30.1
16-Jun-21 01:20:19 PM	0.11	685	0.04	0.7	27.4	30.2
16-Jun-21 01:21:20 PM	0.10	680	0.04	0.6	27.2	30.1
16-Jun-21 01:22:21 PM	0.10	673	0.04	0.6	27.2	30.1
16-Jun-21 01:23:22 PM	0.10	661	0.04	0.5	27.1	30.0
16-Jun-21 01:24:23 PM	0.10	659	0.04	0.5	26.9	29.8
16-Jun-21 01:25:24 PM	0.10	652	0.04	0.5	26.8	29.8
16-Jun-21 01:26:25 PM	0.10	646	0.04	0.4	26.7	29.7
16-Jun-21 01:27:26 PM	0.10	638	0.04	0.4	26.6	29.7
16-Jun-21 01:28:27 PM	0.10	634	0.04	0.4	26.5	29.7
16-Jun-21 01:29:28 PM	0.09	627	0.04	0.4	26.4	29.6
16-Jun-21 01:30:29 PM	0.09	621	0.04	0.4	26.3	29.6
16-Jun-21 01:31:30 PM	0.09	615	0.04	0.4	26.2	29.6
16-Jun-21 01:32:31 PM	0.09	610	0.04	0.4	26.1	29.6
16-Jun-21 01:33:32 PM	0.09	610	0.04	0.4	25.9	29.6
16-Jun-21 01:34:33 PM	0.09	599	0.04	0.4	26.0	29.6
16-Jun-21 01:35:34 PM	0.09	592	0.05	0.4	25.9	29.7
16-Jun-21 01:36:35 PM	0.09	587	0.05	0.4	25.9	29.7
16-Jun-21 01:37:36 PM	0.09	584	0.05	0.4	25.8	29.7
16-Jun-21 01:38:37 PM	0.09	580	0.05	0.5	25.7	29.7
16-Jun-21 01:39:38 PM	0.09	576	0.05	0.5	25.7	29.7
16-Jun-21 01:40:39 PM	0.09	568	0.05	0.5	25.6	29.7
16-Jun-21 01:41:40 PM	0.08	565	0.05	0.5	25.5	29.7
16-Jun-21 01:42:41 PM	0.08	559	0.05	0.5	25.5	29.7
16-Jun-21 01:43:42 PM	0.08	554	0.05	0.5	25.4	29.7
16-Jun-21 01:44:43 PM	0.08	552	0.05	0.5	25.4	29.7
16-Jun-21 01:45:44 PM	0.08	545	0.05	0.5	25.4	29.7
16-Jun-21 01:46:45 PM	0.08	542	0.05	0.5	25.3	29.7
16-Jun-21 01:47:46 PM	0.08	544	0.05	0.6	25.2	29.7
16-Jun-21 01:48:47 PM	0.08	539	0.05	0.6	25.1	29.7
16-Jun-21 01:49:48 PM	0.08	533	0.06	0.6	25.2	29.8
16-Jun-21 01:50:49 PM	0.08	529	0.05	0.6	25.1	29.8
16-Jun-21 01:51:50 PM	0.08	530	0.06	0.6	25.1	29.7
16-Jun-21 01:52:51 PM	0.08	522	0.06	0.6	25.1	29.8
16-Jun-21 01:53:52 PM	0.08	522	0.06	0.6	25.0	29.8
16-Jun-21 01:54:53 PM	0.08	518	0.06	0.6	25.0	29.7
16-Jun-21 01:55:54 PM	0.08	516	0.06	0.6	24.9	29.7
16-Jun-21 01:56:55 PM	0.08	511	0.06	0.6	24.9	29.7
16-Jun-21 01:57:56 PM	0.08	511	0.06	0.7	24.8	29.7
16-Jun-21 01:58:57 PM	0.08	509	0.06	0.7	24.7	29.7
16-Jun-21 01:59:58 PM	0.08	507	0.06	0.7	24.7	29.8
16-Jun-21 02:00:59 PM	0.08	504	0.06	0.7	24.7	29.8
16-Jun-21 02:02:00 PM	0.08	498	0.06	0.7	24.7	29.8
16-Jun-21 02:03:01 PM	0.08	499	0.06	0.7	24.6	29.7
16-Jun-21 02:04:02 PM	0.08	497	0.06	0.7	24.6	29.7
16-Jun-21 02:05:03 PM	0.08	492	0.06	0.7	24.5	29.8
16-Jun-21 02:06:04 PM	0.08	489	0.06	0.7	24.5	29.9
16-Jun-21 02:07:05 PM	0.08	487	0.06	0.7	24.4	29.9

16-Jun-21 02:08:06 PM	0.08	483	0.06	0.7	24.4	30.0
16-Jun-21 02:09:07 PM	0.08	483	0.06	0.7	24.3	30.0
16-Jun-21 02:10:08 PM	0.08	477	0.06	0.7	24.4	30.1
16-Jun-21 02:11:09 PM	0.08	478	0.06	0.7	24.3	30.0
16-Jun-21 02:12:10 PM	0.07	477	0.06	0.7	24.3	30.0
16-Jun-21 02:13:11 PM	0.07	477	0.06	0.8	24.3	30.0
16-Jun-21 02:14:12 PM	0.07	471	0.06	0.8	24.2	30.0
16-Jun-21 02:15:13 PM	0.07	472	0.06	0.8	24.2	30.0
16-Jun-21 02:16:14 PM	0.07	469	0.06	0.8	24.1	30.0
16-Jun-21 02:17:15 PM	0.07	467	0.06	0.8	24.0	30.1
16-Jun-21 02:18:16 PM	0.07	466	0.06	0.8	24.0	30.1
16-Jun-21 02:19:17 PM	0.07	462	0.06	0.8	24.0	30.2
16-Jun-21 02:20:18 PM	0.07	462	0.06	0.8	23.9	30.2
16-Jun-21 02:21:19 PM	0.07	460	0.06	0.8	23.9	30.3
16-Jun-21 02:22:20 PM	0.07	456	0.07	0.8	23.9	30.4
16-Jun-21 02:23:21 PM	0.07	458	0.07	0.8	23.9	30.3
16-Jun-21 02:24:22 PM	0.07	453	0.07	0.8	23.9	30.3
16-Jun-21 02:25:23 PM	0.07	453	0.07	0.8	23.8	30.3
16-Jun-21 02:26:24 PM	0.07	451	0.07	0.8	23.7	30.3
16-Jun-21 02:27:25 PM	0.07	450	0.07	0.8	23.7	30.4
16-Jun-21 02:28:26 PM	0.07	449	0.06	0.8	23.7	30.4
16-Jun-21 02:29:27 PM	0.07	448	0.06	0.8	23.7	30.4
16-Jun-21 02:30:28 PM	0.07	446	0.06	0.8	23.7	30.3
16-Jun-21 02:31:29 PM	0.07	445	0.06	0.8	23.7	30.4
16-Jun-21 02:32:30 PM	0.07	444	0.06	0.8	23.6	30.3
16-Jun-21 02:33:31 PM	0.07	440	0.06	0.9	23.6	30.3
16-Jun-21 02:34:32 PM	0.07	440	0.06	0.9	23.6	30.3
16-Jun-21 02:35:33 PM	0.07	439	0.06	0.9	23.6	30.3
16-Jun-21 02:36:34 PM	0.07	440	0.06	0.9	23.5	30.3
16-Jun-21 02:37:35 PM	0.07	437	0.06	0.9	23.6	30.4
16-Jun-21 02:38:36 PM	0.07	438	0.06	0.9	23.5	30.4
16-Jun-21 02:39:37 PM	0.07	437	0.06	0.9	23.4	30.4
16-Jun-21 02:40:38 PM	0.07	436	0.06	0.9	23.4	30.4
16-Jun-21 02:41:39 PM	0.07	435	0.06	0.9	23.4	30.4
16-Jun-21 02:42:40 PM	0.07	432	0.06	0.9	23.3	30.5
16-Jun-21 02:43:41 PM	0.07	433	0.06	0.9	23.3	30.5
16-Jun-21 02:44:42 PM	0.07	430	0.06	0.9	23.3	30.6
16-Jun-21 02:45:43 PM	0.07	430	0.06	0.9	23.3	30.6
16-Jun-21 02:46:44 PM	0.07	430	0.06	0.9	23.2	30.6
16-Jun-21 02:47:45 PM	0.07	427	0.06	0.9	23.3	30.6
16-Jun-21 02:48:46 PM	0.07	428	0.06	0.9	23.2	30.6
16-Jun-21 02:49:47 PM	0.07	424	0.07	0.9	23.2	30.6
16-Jun-21 02:50:48 PM	0.07	423	0.06	0.9	23.2	30.6
16-Jun-21 02:51:49 PM	0.07	424	0.06	0.9	23.1	30.6
16-Jun-21 02:52:50 PM	0.07	424	0.06	0.9	23.1	30.7
16-Jun-21 02:53:51 PM	0.07	427	0.06	0.9	23.1	30.7
16-Jun-21 02:54:52 PM	0.07	423	0.06	0.9	23.0	30.8
16-Jun-21 02:55:53 PM	0.07	421	0.06	0.9	23.0	30.8
16-Jun-21 02:56:54 PM	0.07	419	0.06	0.9	23.0	30.8
16-Jun-21 02:57:55 PM	0.07	422	0.06	0.9	23.0	30.8
16-Jun-21 02:58:56 PM	0.07	419	0.07	0.9	23.0	30.8
16-Jun-21 02:59:57 PM	0.07	421	0.07	0.9	23.0	30.9
16-Jun-21 03:00:58 PM	0.07	419	0.07	0.9	22.9	30.9
16-Jun-21 03:01:59 PM	0.07	417	0.06	0.9	22.9	30.8
16-Jun-21 03:03:00 PM	0.07	417	0.06	0.9	22.9	30.9
16-Jun-21 03:04:01 PM	0.07	416	0.06	0.9	22.9	30.9
16-Jun-21 03:05:02 PM	0.07	416	0.07	0.9	22.8	30.9

16-Jun-21 03:06:03 PM	0.07	418	0.06	0.9	22.9	31.0
16-Jun-21 03:07:04 PM	0.07	412	0.06	0.9	22.7	31.0
16-Jun-21 03:08:05 PM	0.07	413	0.06	0.9	22.8	31.0
16-Jun-21 03:09:06 PM	0.07	412	0.06	0.9	22.8	31.0
16-Jun-21 03:10:07 PM	0.07	414	0.06	0.9	22.8	31.0
16-Jun-21 03:11:08 PM	0.07	410	0.06	0.9	22.7	31.0
16-Jun-21 03:12:09 PM	0.07	408	0.06	0.9	22.8	31.1
16-Jun-21 03:13:10 PM	0.07	409	0.06	0.9	22.6	31.1
16-Jun-21 03:14:11 PM	0.07	408	0.07	0.9	22.6	31.1
16-Jun-21 03:15:12 PM	0.07	408	0.06	0.9	22.5	31.2
16-Jun-21 03:16:13 PM	0.07	406	0.06	0.9	22.6	31.3
16-Jun-21 03:17:14 PM	0.07	406	0.07	0.9	22.6	31.3
16-Jun-21 03:18:15 PM	0.07	405	0.07	0.9	22.6	31.3
16-Jun-21 03:19:16 PM	0.07	405	0.07	0.9	22.6	31.3
16-Jun-21 03:20:17 PM	0.07	402	0.07	0.9	22.5	31.3
16-Jun-21 03:21:18 PM	0.07	406	0.07	0.9	22.5	31.3
16-Jun-21 03:22:19 PM	0.07	407	0.07	0.9	22.5	31.2
16-Jun-21 03:23:20 PM	0.07	406	0.07	0.9	22.4	31.3
16-Jun-21 03:24:21 PM	0.07	405	0.07	0.9	22.4	31.3
16-Jun-21 03:25:22 PM	0.07	403	0.06	0.9	22.4	31.3
16-Jun-21 03:26:23 PM	0.07	404	0.06	0.9	22.4	31.3
16-Jun-21 03:27:24 PM	0.07	403	0.07	0.9	22.4	31.3
16-Jun-21 03:28:25 PM	0.07	402	0.07	0.9	22.4	31.3
16-Jun-21 03:29:26 PM	0.07	404	0.06	1.0	22.3	31.3
16-Jun-21 03:30:27 PM	0.07	403	0.06	0.9	22.3	31.3
16-Jun-21 03:31:28 PM	0.07	400	0.06	0.9	22.3	31.3
16-Jun-21 03:32:29 PM	0.07	402	0.07	0.9	22.2	31.4
16-Jun-21 03:33:30 PM	0.07	401	0.07	0.9	22.2	31.4
16-Jun-21 03:34:31 PM	0.07	402	0.07	0.9	22.3	31.4
16-Jun-21 03:35:32 PM	0.07	398	0.06	0.9	22.3	31.5
16-Jun-21 03:36:33 PM	0.07	401	0.07	0.9	22.2	31.4
16-Jun-21 03:37:34 PM	0.07	401	0.06	0.9	22.2	31.4
16-Jun-21 03:38:35 PM	0.07	403	0.07	1.0	22.2	31.5
16-Jun-21 03:39:36 PM	0.07	397	0.07	1.0	22.1	31.5
16-Jun-21 03:40:37 PM	0.07	398	0.07	0.9	22.2	31.6
16-Jun-21 03:41:38 PM	0.07	396	0.07	0.9	22.2	31.6
16-Jun-21 03:42:39 PM	0.07	397	0.07	1.0	22.1	31.6
16-Jun-21 03:43:40 PM	0.07	398	0.07	1.0	22.1	31.6
16-Jun-21 03:44:41 PM	0.07	396	0.07	1.0	22.0	31.6
16-Jun-21 03:45:42 PM	0.07	395	0.07	1.0	22.0	31.6
16-Jun-21 03:46:43 PM	0.07	397	0.07	1.0	22.0	31.7
16-Jun-21 03:47:44 PM	0.07	393	0.07	1.0	22.0	31.7
16-Jun-21 03:48:45 PM	0.07	394	0.07	1.0	22.0	31.7
16-Jun-21 03:49:46 PM	0.07	394	0.07	0.9	22.0	31.8
16-Jun-21 03:50:47 PM	0.07	394	0.07	1.0	22.0	31.8
16-Jun-21 03:51:48 PM	0.07	393	0.07	1.0	21.9	31.8
16-Jun-21 03:52:49 PM	0.07	393	0.07	1.0	22.0	31.8
16-Jun-21 03:53:50 PM	0.07	391	0.06	0.9	21.9	31.8
16-Jun-21 03:54:51 PM	0.07	395	0.07	1.0	21.9	31.7
16-Jun-21 03:55:52 PM	0.07	394	0.07	1.0	21.9	31.8
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16-Jun-21 03:59:56 PM	0.07	391	0.06	0.9	21.8	31.8
16-Jun-21 04:00:57 PM	0.07	391	0.07	1.0	21.7	31.7
16-Jun-21 04:01:58 PM	0.07	392	0.07	1.0	21.7	31.8
16-Jun-21 04:02:59 PM	0.07	391	0.07	0.9	21.6	31.8

16-Jun-21 04:04:00 PM	0.07	392	0.07	0.9	21.6	31.9
16-Jun-21 04:05:01 PM	0.07	388	0.07	0.9	21.7	31.9
16-Jun-21 04:06:02 PM	0.07	390	0.07	0.9	21.7	31.9
16-Jun-21 04:07:03 PM	0.07	387	0.07	0.9	21.7	32.0
16-Jun-21 04:08:04 PM	0.07	389	0.07	1.0	21.7	32.0
16-Jun-21 04:09:05 PM	0.07	390	0.07	1.0	21.7	32.0
16-Jun-21 04:10:06 PM	0.07	389	0.06	0.9	21.7	31.9
16-Jun-21 04:11:07 PM	0.07	387	0.07	1.0	21.7	31.9
16-Jun-21 04:12:08 PM	0.07	389	0.07	1.0	21.6	31.9
16-Jun-21 04:13:09 PM	0.07	390	0.07	1.0	21.6	31.9
16-Jun-21 04:14:10 PM	0.07	390	0.07	1.0	21.6	32.0
16-Jun-21 04:15:11 PM	0.07	387	0.07	1.0	21.5	32.0
16-Jun-21 04:16:12 PM	0.07	388	0.07	1.0	21.6	32.0
16-Jun-21 04:17:13 PM	0.07	385	0.07	1.0	21.6	32.0
16-Jun-21 04:18:14 PM	0.07	387	0.06	1.0	21.6	32.0
16-Jun-21 04:19:15 PM	0.07	386	0.06	1.0	21.5	32.0
16-Jun-21 04:20:16 PM	0.07	385	0.07	1.0	21.5	32.0
16-Jun-21 04:21:17 PM	0.07	387	0.07	1.0	21.5	31.9
16-Jun-21 04:22:18 PM	0.07	387	0.07	1.0	21.5	32.0
16-Jun-21 04:23:19 PM	0.07	386	0.07	1.0	21.4	32.0
16-Jun-21 04:24:20 PM	0.07	382	0.07	1.0	21.4	32.0
16-Jun-21 04:25:21 PM	0.07	386	0.07	1.0	21.4	32.1
16-Jun-21 04:26:22 PM	0.07	386	0.07	1.0	21.4	32.2
16-Jun-21 04:27:23 PM	0.07	385	0.07	1.0	21.4	32.2
16-Jun-21 04:28:24 PM	0.07	385	0.07	1.0	21.4	32.2
16-Jun-21 04:29:25 PM	0.07	385	0.07	1.0	21.3	32.2
16-Jun-21 04:30:26 PM	0.07	383	0.07	1.0	21.4	32.3
16-Jun-21 04:31:27 PM	0.07	384	0.07	1.0	21.3	32.3
16-Jun-21 04:32:28 PM	0.07	384	0.07	1.0	21.3	32.3
16-Jun-21 04:33:29 PM	0.07	381	0.07	1.0	21.4	32.3
16-Jun-21 04:34:30 PM	0.07	381	0.07	1.0	21.3	32.3
16-Jun-21 04:35:31 PM	0.07	384	0.07	1.0	21.3	32.2
16-Jun-21 04:36:32 PM	0.07	383	0.07	1.0	21.2	32.3
16-Jun-21 04:37:33 PM	0.07	381	0.07	1.0	21.3	32.3
16-Jun-21 04:38:34 PM	0.07	377	0.07	1.0	21.2	32.3
16-Jun-21 04:39:35 PM	0.07	382	0.07	1.0	21.2	32.3
16-Jun-21 04:40:36 PM	0.07	384	0.07	1.0	21.2	32.3
16-Jun-21 04:41:37 PM	0.06	380	0.07	1.0	21.2	32.3
16-Jun-21 04:42:38 PM	0.06	383	0.07	1.0	21.1	32.3
16-Jun-21 04:43:39 PM	0.06	382	0.07	1.0	21.1	32.4
16-Jun-21 04:44:40 PM	0.06	380	0.07	1.0	21.1	32.5
16-Jun-21 04:45:41 PM	0.06	379	0.07	1.0	21.1	32.5
16-Jun-21 04:46:42 PM	0.06	377	0.07	1.0	21.1	32.5
16-Jun-21 04:47:43 PM	0.06	379	0.07	1.0	21.1	32.5
16-Jun-21 04:48:44 PM	0.06	381	0.07	1.0	21.1	32.5
16-Jun-21 04:49:45 PM	0.06	379	0.07	1.0	21.1	32.5
16-Jun-21 04:50:46 PM	0.06	380	0.07	1.0	21.1	32.5
16-Jun-21 04:51:47 PM	0.06	380	0.08	1.0	21.0	32.6
16-Jun-21 04:52:48 PM	0.06	380	0.07	1.0	21.0	32.6
16-Jun-21 04:53:49 PM	0.06	379	0.07	1.0	21.0	32.6
16-Jun-21 04:54:50 PM	0.06	383	0.08	1.0	20.9	32.6
16-Jun-21 04:55:51 PM	0.06	378	0.08	1.0	20.9	32.7
16-Jun-21 04:56:52 PM	0.06	377	0.07	1.0	21.0	32.6
16-Jun-21 04:57:53 PM	0.06	379	0.08	1.0	20.9	32.6
16-Jun-21 04:58:54 PM	0.06	379	0.08	1.0	20.9	32.7
16-Jun-21 04:59:55 PM	0.06	379	0.08	1.0	20.9	32.6
16-Jun-21 05:00:56 PM	0.06	377	0.08	1.0	20.9	32.6

16-Jun-21 05:01:57 PM	0.06	379	0.08	1.0	20.8	32.6
16-Jun-21 05:02:58 PM	0.06	379	0.08	1.0	20.9	32.7
16-Jun-21 05:03:59 PM	0.06	378	0.08	1.1	20.8	32.7
16-Jun-21 05:05:00 PM	0.06	378	0.08	1.1	20.8	32.8
16-Jun-21 05:06:01 PM	0.06	378	0.08	1.0	20.9	32.8
16-Jun-21 05:07:02 PM	0.06	379	0.07	1.1	20.8	32.7
16-Jun-21 05:08:03 PM	0.06	379	0.07	1.1	20.8	32.7
16-Jun-21 05:09:04 PM	0.06	376	0.07	1.1	20.8	32.7
16-Jun-21 05:10:05 PM	0.07	379	0.07	1.1	20.8	32.7
16-Jun-21 05:11:06 PM	0.06	378	0.07	1.1	20.8	32.8
16-Jun-21 05:12:07 PM	0.06	379	0.07	1.1	20.8	32.8
16-Jun-21 05:13:08 PM	0.06	380	0.08	1.1	20.8	32.8
16-Jun-21 05:14:09 PM	0.06	378	0.07	1.1	20.8	32.8
16-Jun-21 05:15:10 PM	0.06	378	0.08	1.1	20.8	32.7
16-Jun-21 05:16:11 PM	0.06	380	0.08	1.1	20.8	32.7
16-Jun-21 05:17:12 PM	0.06	377	0.08	1.1	20.8	32.7
16-Jun-21 05:18:13 PM	0.06	377	0.08	1.1	20.8	32.7
16-Jun-21 05:19:14 PM	0.06	379	0.08	1.1	20.7	32.7
16-Jun-21 05:20:15 PM	0.06	380	0.08	1.1	20.8	32.7
16-Jun-21 05:21:16 PM	0.06	379	0.08	1.1	20.7	32.7
16-Jun-21 05:22:17 PM	0.06	377	0.08	1.2	20.7	32.7
16-Jun-21 05:23:18 PM	0.06	378	0.08	1.1	20.7	32.7
16-Jun-21 05:24:19 PM	0.06	378	0.08	1.1	20.7	32.7
16-Jun-21 05:25:20 PM	0.06	377	0.08	1.1	20.6	32.7
16-Jun-21 05:26:21 PM	0.06	377	0.08	1.1	20.7	32.8
16-Jun-21 05:27:22 PM	0.06	377	0.08	1.1	20.6	32.8
16-Jun-21 05:28:23 PM	0.06	379	0.08	1.1	20.6	32.8
16-Jun-21 05:29:24 PM	0.06	378	0.08	1.1	20.6	32.8
16-Jun-21 05:30:25 PM	0.06	380	0.08	1.1	20.5	32.8
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16-Jun-21 05:33:28 PM	0.06	377	0.08	1.1	20.5	32.9
16-Jun-21 05:34:29 PM	0.06	377	0.08	1.1	20.5	32.9
16-Jun-21 05:35:30 PM	0.06	378	0.08	1.1	20.5	32.9
16-Jun-21 05:36:31 PM	0.06	376	0.08	1.1	20.5	32.8
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16-Jun-21 05:39:34 PM	0.06	377	0.08	1.1	20.6	32.9
16-Jun-21 05:40:35 PM	0.06	378	0.08	1.1	20.5	32.9
16-Jun-21 05:41:36 PM	0.06	379	0.08	1.2	20.5	32.8
16-Jun-21 05:42:37 PM	0.06	377	0.08	1.2	20.4	32.9
16-Jun-21 05:43:38 PM	0.06	377	0.08	1.1	20.5	33.0
16-Jun-21 05:44:39 PM	0.06	377	0.08	1.1	20.4	33.0
16-Jun-21 05:45:40 PM	0.06	376	0.08	1.2	20.4	33.0
16-Jun-21 05:46:41 PM	0.06	379	0.08	1.2	20.4	33.0
16-Jun-21 05:47:42 PM	0.06	381	0.08	1.1	20.4	33.1
16-Jun-21 05:48:43 PM	0.06	377	0.08	1.2	20.4	33.1
16-Jun-21 05:49:44 PM	0.06	375	0.08	1.2	20.3	33.2
16-Jun-21 05:50:45 PM	0.06	379	0.08	1.2	20.3	33.2
16-Jun-21 05:51:46 PM	0.06	376	0.08	1.1	20.3	33.3
16-Jun-21 05:52:47 PM	0.06	379	0.08	1.2	20.3	33.3
16-Jun-21 05:53:48 PM	0.06	376	0.08	1.1	20.3	33.3
16-Jun-21 05:54:49 PM	0.06	374	0.08	1.1	20.3	33.2
16-Jun-21 05:55:50 PM	0.06	377	0.08	1.2	20.3	33.2
16-Jun-21 05:56:51 PM	0.06	376	0.08	1.2	20.3	33.2
16-Jun-21 05:57:52 PM	0.06	375	0.08	1.2	20.2	33.3
16-Jun-21 05:58:53 PM	0.06	374	0.08	1.2	20.3	33.4

16-Jun-21 05:59:54 PM	0.06	375	0.08	1.2	20.3	33.4
16-Jun-21 06:00:55 PM	0.06	376	0.08	1.2	20.2	33.3
16-Jun-21 06:01:56 PM	0.06	375	0.08	1.2	20.3	33.3
16-Jun-21 06:02:57 PM	0.06	374	0.08	1.2	20.3	33.4
16-Jun-21 06:03:58 PM	0.06	374	0.08	1.2	20.2	33.4
16-Jun-21 06:04:59 PM	0.07	373	0.08	1.2	20.2	33.4
16-Jun-21 06:06:00 PM	0.07	376	0.08	1.2	20.2	33.5
16-Jun-21 06:07:01 PM	0.06	376	0.08	1.2	20.2	33.5
16-Jun-21 06:08:02 PM	0.07	376	0.08	1.2	20.1	33.4
16-Jun-21 06:09:03 PM	0.07	375	0.08	1.2	20.1	33.5
16-Jun-21 06:10:04 PM	0.07	373	0.08	1.2	20.1	33.5
16-Jun-21 06:11:05 PM	0.07	372	0.08	1.2	20.1	33.6
16-Jun-21 06:12:06 PM	0.07	375	0.08	1.2	20.1	33.6
16-Jun-21 06:13:07 PM	0.07	376	0.08	1.2	20.1	33.6
16-Jun-21 06:14:08 PM	0.07	374	0.08	1.2	20.1	33.6
16-Jun-21 06:15:09 PM	0.07	374	0.08	1.2	20.1	33.6
16-Jun-21 06:16:10 PM	0.07	374	0.08	1.2	20.1	33.6
16-Jun-21 06:17:11 PM	0.06	371	0.08	1.2	20.1	33.7
16-Jun-21 06:18:12 PM	0.07	374	0.08	1.2	20.2	33.7
16-Jun-21 06:19:13 PM	0.07	374	0.08	1.2	20.1	33.6
16-Jun-21 06:20:14 PM	0.07	375	0.08	1.2	20.1	33.6
16-Jun-21 06:21:15 PM	0.07	373	0.08	1.2	20.1	33.6
16-Jun-21 06:22:16 PM	0.07	375	0.08	1.2	20.0	33.5
16-Jun-21 06:23:17 PM	0.07	377	0.08	1.2	20.1	33.7
16-Jun-21 06:24:18 PM	0.07	375	0.08	1.2	20.0	33.7
16-Jun-21 06:25:19 PM	0.07	374	0.08	1.2	20.0	33.7
16-Jun-21 06:26:20 PM	0.07	376	0.08	1.2	20.0	33.7
16-Jun-21 06:27:21 PM	0.07	375	0.08	1.2	20.0	33.7
16-Jun-21 06:28:22 PM	0.07	375	0.08	1.2	20.0	33.7
16-Jun-21 06:29:23 PM	0.07	375	0.08	1.2	20.0	33.7
16-Jun-21 06:30:24 PM	0.06	374	0.08	1.2	20.0	33.7
16-Jun-21 06:31:25 PM	0.07	374	0.08	1.2	19.9	33.7
16-Jun-21 06:32:26 PM	0.07	374	0.08	1.2	20.0	33.7
16-Jun-21 06:33:27 PM	0.07	373	0.08	1.2	19.9	33.7
16-Jun-21 06:34:28 PM	0.07	375	0.08	1.2	19.9	33.7
16-Jun-21 06:35:29 PM	0.07	373	0.07	1.2	19.8	33.6
16-Jun-21 06:36:30 PM	0.07	373	0.08	1.2	20.0	33.7
16-Jun-21 06:37:31 PM	0.07	372	0.08	1.2	19.9	33.7
16-Jun-21 06:38:32 PM	0.07	373	0.08	1.2	19.8	33.6
16-Jun-21 06:39:33 PM	0.07	374	0.08	1.2	19.9	33.7
16-Jun-21 06:40:34 PM	0.07	373	0.08	1.2	19.9	33.7
16-Jun-21 06:41:35 PM	0.06	373	0.08	1.2	19.9	33.6
16-Jun-21 06:42:36 PM	0.06	371	0.08	1.2	19.9	33.6
16-Jun-21 06:43:37 PM	0.06	372	0.08	1.2	19.8	33.7
16-Jun-21 06:44:38 PM	0.06	375	0.08	1.2	19.8	33.6
16-Jun-21 06:45:39 PM	0.06	375	0.08	1.1	19.8	33.6
16-Jun-21 06:46:40 PM	0.07	372	0.07	1.2	19.8	33.6
16-Jun-21 06:47:41 PM	0.07	371	0.07	1.2	19.8	33.6
16-Jun-21 06:48:42 PM	0.06	372	0.08	1.2	19.8	33.6
16-Jun-21 06:49:43 PM	0.07	376	0.07	1.2	19.8	33.6
16-Jun-21 06:50:44 PM	0.07	375	0.07	1.2	19.7	33.6
16-Jun-21 06:51:45 PM	0.06	369	0.07	1.1	19.8	33.6
16-Jun-21 06:52:46 PM	0.07	368	0.07	1.1	19.8	33.6
16-Jun-21 06:53:47 PM	0.07	373	0.07	1.2	19.8	33.6
16-Jun-21 06:54:48 PM	0.07	371	0.07	1.2	19.8	33.6
16-Jun-21 06:55:49 PM	0.07	370	0.07	1.2	19.8	33.6
16-Jun-21 06:56:50 PM	0.07	372	0.07	1.2	19.7	33.6

16-Jun-21 06:57:51 PM	0.07	372	0.07	1.2	19.7	33.6
16-Jun-21 06:58:52 PM	0.07	372	0.07	1.1	19.7	33.7
16-Jun-21 06:59:53 PM	0.07	372	0.07	1.1	19.7	33.7
16-Jun-21 07:00:54 PM	0.07	368	0.07	1.1	19.8	33.7
16-Jun-21 07:01:55 PM	0.07	370	0.07	1.1	19.7	33.6
16-Jun-21 07:02:56 PM	0.07	369	0.07	1.2	19.7	33.6
16-Jun-21 07:03:57 PM	0.07	371	0.07	1.2	19.7	33.6
16-Jun-21 07:04:58 PM	0.07	372	0.07	1.2	19.7	33.6
16-Jun-21 07:05:59 PM	0.07	370	0.07	1.1	19.6	33.6
16-Jun-21 07:07:00 PM	0.07	370	0.07	1.1	19.6	33.6
16-Jun-21 07:08:01 PM	0.07	371	0.07	1.1	19.6	33.6
16-Jun-21 07:09:02 PM	0.07	371	0.07	1.1	19.6	33.7
16-Jun-21 07:10:03 PM	0.07	369	0.07	1.1	19.6	33.7
16-Jun-21 07:11:04 PM	0.07	368	0.07	1.1	19.6	33.7
16-Jun-21 07:12:05 PM	0.07	370	0.06	1.1	19.6	33.7
16-Jun-21 07:13:06 PM	0.07	372	0.07	1.1	19.5	33.7
16-Jun-21 07:14:07 PM	0.07	371	0.06	1.1	19.6	33.7
16-Jun-21 07:15:08 PM	0.07	372	0.07	1.1	19.6	33.7
16-Jun-21 07:16:09 PM	0.07	371	0.06	1.1	19.6	33.7
16-Jun-21 07:17:10 PM	0.07	370	0.06	1.1	19.6	33.7
16-Jun-21 07:18:11 PM	0.07	371	0.06	1.1	19.5	33.7
16-Jun-21 07:19:12 PM	0.07	369	0.07	1.1	19.4	33.8
16-Jun-21 07:20:13 PM	0.07	367	0.07	1.1	19.5	33.9
16-Jun-21 07:21:14 PM	0.07	368	0.06	1.1	19.5	33.9
16-Jun-21 07:22:15 PM	0.07	369	0.06	1.1	19.5	33.9
16-Jun-21 07:23:16 PM	0.07	370	0.06	1.1	19.5	33.9
16-Jun-21 07:24:17 PM	0.07	370	0.06	1.1	19.5	33.9
16-Jun-21 07:25:18 PM	0.07	368	0.06	1.1	19.5	33.9
16-Jun-21 07:26:19 PM	0.07	367	0.06	1.1	19.4	33.9
16-Jun-21 07:27:20 PM	0.07	367	0.06	1.1	19.5	33.9
16-Jun-21 07:28:21 PM	0.07	369	0.06	1.1	19.5	33.8
16-Jun-21 07:29:22 PM	0.07	370	0.06	1.1	19.4	33.8
16-Jun-21 07:30:23 PM	0.07	370	0.06	1.1	19.4	33.9
16-Jun-21 07:31:24 PM	0.07	369	0.06	1.1	19.5	33.9
16-Jun-21 07:32:25 PM	0.07	367	0.06	1.1	19.4	33.9
16-Jun-21 07:33:26 PM	0.07	366	0.06	1.1	19.4	33.9
16-Jun-21 07:34:27 PM	0.07	367	0.06	1.1	19.3	33.9
16-Jun-21 07:35:28 PM	0.07	368	0.06	1.1	19.4	33.9
16-Jun-21 07:36:29 PM	0.07	367	0.06	1.1	19.5	33.9
16-Jun-21 07:37:30 PM	0.07	365	0.06	1.1	19.4	33.8
16-Jun-21 07:38:31 PM	0.07	367	0.06	1.1	19.4	33.9
16-Jun-21 07:39:32 PM	0.07	368	0.06	1.1	19.3	33.8
16-Jun-21 07:40:33 PM	0.07	368	0.06	1.1	19.4	33.9
16-Jun-21 07:41:34 PM	0.07	369	0.06	1.1	19.4	33.8
16-Jun-21 07:42:35 PM	0.07	368	0.06	1.1	19.4	33.8
16-Jun-21 07:43:36 PM	0.07	369	0.06	1.1	19.3	33.9
16-Jun-21 07:44:37 PM	0.07	366	0.06	1.1	19.3	33.9
16-Jun-21 07:45:38 PM	0.07	365	0.06	1.1	19.2	34.0
16-Jun-21 07:46:39 PM	0.07	367	0.06	1.1	19.2	34.1
16-Jun-21 07:47:40 PM	0.07	364	0.06	1.1	19.2	34.1
16-Jun-21 07:48:41 PM	0.07	364	0.06	1.1	19.3	34.2
16-Jun-21 07:49:42 PM	0.07	366	0.06	1.1	19.3	34.2
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16-Jun-21 07:55:48 PM	0.07	365	0.06	1.1	19.2	34.1
16-Jun-21 07:56:49 PM	0.07	365	0.06	1.1	19.2	34.1
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16-Jun-21 07:59:52 PM	0.07	365	0.06	1.1	19.1	34.0
16-Jun-21 08:00:53 PM	0.07	365	0.06	1.1	19.1	34.1
16-Jun-21 08:01:54 PM	0.07	364	0.06	1.1	19.1	34.1
16-Jun-21 08:02:55 PM	0.07	363	0.06	1.1	19.1	34.2
16-Jun-21 08:03:56 PM	0.07	362	0.06	1.1	19.2	34.2
16-Jun-21 08:04:57 PM	0.07	361	0.06	1.1	19.1	34.2
16-Jun-21 08:05:58 PM	0.07	364	0.06	1.1	19.1	34.1
16-Jun-21 08:06:59 PM	0.07	365	0.06	1.1	19.1	34.1
16-Jun-21 08:08:00 PM	0.07	366	0.06	1.1	19.1	34.1
16-Jun-21 08:09:01 PM	0.07	363	0.06	1.1	19.1	34.1
16-Jun-21 08:10:02 PM	0.07	365	0.06	1.1	19.1	34.1
16-Jun-21 08:11:03 PM	0.07	364	0.06	1.1	19.1	34.1
16-Jun-21 08:12:04 PM	0.07	363	0.06	1.1	19.1	34.1
16-Jun-21 08:13:05 PM	0.07	364	0.06	1.1	19.0	34.1
16-Jun-21 08:14:06 PM	0.07	364	0.06	1.1	19.0	34.2
16-Jun-21 08:15:07 PM	0.07	363	0.06	1.1	19.1	34.2
16-Jun-21 08:16:08 PM	0.07	365	0.06	1.1	19.0	34.2
16-Jun-21 08:17:09 PM	0.07	364	0.06	1.1	19.0	34.2
16-Jun-21 08:18:10 PM	0.07	363	0.06	1.1	19.0	34.2
16-Jun-21 08:19:11 PM	0.07	363	0.06	1.1	19.0	34.3
16-Jun-21 08:20:12 PM	0.07	362	0.06	1.1	19.0	34.3
16-Jun-21 08:21:13 PM	0.07	362	0.06	1.1	19.0	34.2
16-Jun-21 08:22:14 PM	0.07	362	0.06	1.1	19.0	34.2
16-Jun-21 08:23:15 PM	0.07	365	0.06	1.1	18.9	34.2
16-Jun-21 08:24:16 PM	0.07	361	0.06	1.1	19.0	34.2
16-Jun-21 08:25:17 PM	0.07	362	0.06	1.1	19.0	34.2
16-Jun-21 08:26:18 PM	0.07	363	0.06	1.1	19.0	34.1
16-Jun-21 08:27:19 PM	0.07	361	0.06	1.1	19.0	34.1
16-Jun-21 08:28:20 PM	0.07	365	0.05	1.1	19.0	34.1
16-Jun-21 08:29:21 PM	0.07	363	0.06	1.1	19.0	34.0
16-Jun-21 08:30:22 PM	0.07	364	0.05	1.1	19.0	34.0
16-Jun-21 08:31:23 PM	0.07	362	0.05	1.1	18.9	33.9
16-Jun-21 08:32:24 PM	0.07	361	0.05	1.1	18.9	34.0
16-Jun-21 08:33:25 PM	0.07	366	0.05	1.1	18.9	34.0
16-Jun-21 08:34:26 PM	0.07	367	0.05	1.1	19.0	34.0
16-Jun-21 08:35:27 PM	0.07	363	0.05	1.1	18.9	34.0
16-Jun-21 08:36:28 PM	0.07	365	0.05	1.1	18.9	34.0
16-Jun-21 08:37:29 PM	0.07	360	0.05	1.1	19.0	34.0
16-Jun-21 08:38:30 PM	0.07	361	0.05	1.1	18.9	34.0
16-Jun-21 08:39:31 PM	0.07	363	0.05	1.1	18.8	34.0
16-Jun-21 08:40:32 PM	0.07	362	0.05	1.1	18.8	34.1
16-Jun-21 08:41:33 PM	0.07	363	0.05	1.1	18.9	34.2
16-Jun-21 08:42:34 PM	0.07	362	0.05	1.1	18.8	34.2
16-Jun-21 08:43:35 PM	0.07	361	0.05	1.1	18.8	34.2
16-Jun-21 08:44:36 PM	0.07	361	0.05	1.1	18.8	34.2
16-Jun-21 08:45:37 PM	0.07	362	0.05	1.1	18.9	34.3
16-Jun-21 08:46:38 PM	0.07	362	0.05	1.1	18.9	34.2
16-Jun-21 08:47:39 PM	0.07	360	0.05	1.1	18.8	34.2
16-Jun-21 08:48:40 PM	0.07	359	0.05	1.1	18.8	34.2
16-Jun-21 08:49:41 PM	0.07	361	0.05	1.1	18.8	34.3
16-Jun-21 08:50:42 PM	0.07	360	0.05	1.1	18.8	34.3
16-Jun-21 08:51:43 PM	0.07	359	0.05	1.1	18.9	34.3
16-Jun-21 08:52:44 PM	0.07	361	0.05	1.1	18.8	34.2

16-Jun-21 08:53:45 PM	0.07	362	0.05	1.1	18.7	34.2
16-Jun-21 08:54:46 PM	0.07	363	0.05	1.1	18.7	34.2
16-Jun-21 08:55:47 PM	0.07	360	0.05	1.1	18.7	34.3
16-Jun-21 08:56:48 PM	0.07	358	0.05	1.1	18.7	34.3
16-Jun-21 08:57:49 PM	0.07	362	0.05	1.1	18.7	34.4
16-Jun-21 08:58:50 PM	0.07	360	0.05	1.1	18.7	34.3
16-Jun-21 08:59:51 PM	0.07	358	0.05	1.0	18.7	34.3
16-Jun-21 09:00:52 PM	0.07	361	0.05	1.1	18.7	34.4
16-Jun-21 09:01:53 PM	0.07	358	0.05	1.1	18.7	34.3
16-Jun-21 09:02:54 PM	0.07	360	0.05	1.0	18.7	34.3
16-Jun-21 09:03:55 PM	0.07	356	0.05	1.0	18.7	34.3
16-Jun-21 09:04:56 PM	0.07	358	0.05	1.1	18.7	34.4
16-Jun-21 09:05:57 PM	0.07	360	0.05	1.0	18.8	34.4
16-Jun-21 09:06:58 PM	0.07	359	0.05	1.1	18.7	34.3
16-Jun-21 09:07:59 PM	0.07	359	0.05	1.1	18.7	34.3
16-Jun-21 09:09:00 PM	0.07	358	0.05	1.1	18.7	34.4
16-Jun-21 09:10:01 PM	0.07	358	0.05	1.0	18.7	34.4
16-Jun-21 09:11:02 PM	0.07	360	0.05	1.1	18.6	34.4
16-Jun-21 09:12:03 PM	0.07	357	0.05	1.1	18.6	34.5
16-Jun-21 09:13:04 PM	0.07	357	0.05	1.0	18.6	34.4
16-Jun-21 09:14:05 PM	0.07	360	0.05	1.0	18.6	34.5
16-Jun-21 09:15:06 PM	0.07	358	0.05	1.0	18.7	34.4
16-Jun-21 09:16:07 PM	0.07	358	0.05	1.0	18.7	34.4
16-Jun-21 09:17:08 PM	0.07	360	0.05	1.0	18.6	34.4
16-Jun-21 09:18:09 PM	0.07	361	0.06	1.0	18.6	34.4
16-Jun-21 09:19:10 PM	0.07	360	0.06	1.0	18.5	34.4
16-Jun-21 09:20:11 PM	0.07	360	0.06	1.0	18.5	34.5
16-Jun-21 09:21:12 PM	0.07	361	0.06	1.0	18.5	34.5
16-Jun-21 09:22:13 PM	0.07	357	0.06	1.0	18.6	34.5
16-Jun-21 09:23:14 PM	0.07	357	0.05	1.0	18.6	34.5
16-Jun-21 09:24:15 PM	0.07	357	0.05	1.0	18.6	34.5
16-Jun-21 09:25:16 PM	0.07	359	0.05	1.1	18.6	34.4
16-Jun-21 09:26:17 PM	0.07	358	0.05	1.1	18.5	34.4
16-Jun-21 09:27:18 PM	0.07	359	0.05	1.0	18.6	34.4
16-Jun-21 09:28:19 PM	0.07	356	0.05	1.0	18.6	34.4
16-Jun-21 09:29:20 PM	0.07	358	0.05	1.0	18.5	34.4
16-Jun-21 09:30:21 PM	0.07	358	0.05	1.0	18.5	34.4
16-Jun-21 09:31:22 PM	0.07	356	0.06	1.0	18.5	34.4
16-Jun-21 09:32:23 PM	0.07	358	0.05	1.0	18.5	34.5
16-Jun-21 09:33:24 PM	0.07	356	0.05	1.0	18.6	34.6
16-Jun-21 09:34:25 PM	0.07	357	0.05	1.0	18.5	34.5
16-Jun-21 09:35:26 PM	0.07	359	0.05	1.0	18.5	34.5
16-Jun-21 09:36:27 PM	0.07	359	0.05	1.0	18.5	34.5
16-Jun-21 09:37:28 PM	0.07	357	0.05	1.0	18.6	34.4
16-Jun-21 09:38:29 PM	0.07	358	0.05	1.0	18.5	34.5
16-Jun-21 09:39:30 PM	0.07	355	0.05	1.0	18.5	34.5
16-Jun-21 09:40:31 PM	0.07	355	0.05	1.0	18.5	34.5
16-Jun-21 09:41:32 PM	0.07	359	0.05	1.0	18.5	34.5
16-Jun-21 09:42:33 PM	0.07	359	0.06	1.0	18.5	34.5
16-Jun-21 09:43:34 PM	0.07	360	0.06	1.0	18.5	34.5
16-Jun-21 09:44:35 PM	0.07	356	0.05	1.0	18.5	34.4
16-Jun-21 09:45:36 PM	0.07	359	0.05	1.0	18.5	34.4
16-Jun-21 09:46:37 PM	0.07	357	0.05	1.0	18.6	34.5
16-Jun-21 09:47:38 PM	0.07	359	0.05	1.0	18.6	34.4
16-Jun-21 09:48:39 PM	0.07	358	0.05	1.0	18.5	34.4
16-Jun-21 09:49:40 PM	0.07	358	0.05	1.0	18.5	34.3
16-Jun-21 09:50:41 PM	0.07	358	0.05	1.0	18.4	34.3

16-Jun-21 09:51:42 PM	0.07	356	0.05	1.0	18.4	34.4
16-Jun-21 09:52:43 PM	0.07	358	0.05	1.0	18.5	34.4
16-Jun-21 09:53:44 PM	0.07	358	0.05	1.0	18.4	34.3
16-Jun-21 09:54:45 PM	0.07	357	0.05	1.0	18.4	34.4
16-Jun-21 09:55:46 PM	0.07	355	0.05	1.0	18.4	34.4
16-Jun-21 09:56:47 PM	0.07	358	0.05	1.0	18.4	34.4
16-Jun-21 09:57:48 PM	0.07	356	0.05	1.0	18.4	34.3
16-Jun-21 09:58:49 PM	0.07	359	0.05	1.0	18.3	34.3
16-Jun-21 09:59:50 PM	0.07	359	0.05	1.0	18.4	34.4
16-Jun-21 10:00:51 PM	0.07	358	0.05	1.0	18.3	34.3
16-Jun-21 10:01:52 PM	0.07	359	0.05	1.0	18.3	34.3
16-Jun-21 10:02:53 PM	0.07	356	0.05	1.0	18.3	34.4
16-Jun-21 10:03:54 PM	0.07	357	0.05	1.0	18.3	34.5
16-Jun-21 10:04:55 PM	0.07	360	0.05	1.0	18.3	34.5
16-Jun-21 10:05:56 PM	0.07	358	0.05	1.0	18.3	34.4
16-Jun-21 10:06:57 PM	0.07	357	0.05	1.0	18.3	34.5
16-Jun-21 10:07:58 PM	0.07	355	0.05	1.0	18.4	34.4
16-Jun-21 10:08:59 PM	0.07	356	0.05	1.0	18.4	34.4
16-Jun-21 10:10:00 PM	0.07	354	0.05	1.0	18.3	34.3
16-Jun-21 10:11:01 PM	0.07	357	0.05	1.0	18.3	34.3
16-Jun-21 10:12:02 PM	0.07	359	0.05	1.0	18.4	34.3
16-Jun-21 10:13:03 PM	0.07	355	0.05	1.0	18.3	34.3
16-Jun-21 10:14:04 PM	0.07	356	0.05	1.0	18.2	34.3
16-Jun-21 10:15:05 PM	0.07	355	0.05	1.0	18.3	34.4
16-Jun-21 10:16:06 PM	0.07	356	0.05	1.0	18.3	34.4
16-Jun-21 10:17:07 PM	0.07	356	0.05	1.0	18.3	34.5
16-Jun-21 10:18:08 PM	0.07	357	0.05	1.0	18.2	34.5
16-Jun-21 10:19:09 PM	0.07	355	0.05	1.0	18.2	34.5
16-Jun-21 10:20:10 PM	0.07	358	0.05	1.0	18.2	34.6
16-Jun-21 10:21:11 PM	0.07	358	0.05	1.0	18.2	34.6
16-Jun-21 10:22:12 PM	0.07	357	0.05	1.0	18.2	34.5
16-Jun-21 10:23:13 PM	0.07	354	0.05	1.0	18.2	34.5
16-Jun-21 10:24:14 PM	0.07	356	0.05	1.0	18.2	34.5
16-Jun-21 10:25:15 PM	0.07	357	0.05	1.0	18.1	34.6
16-Jun-21 10:26:16 PM	0.07	356	0.05	1.0	18.1	34.6
16-Jun-21 10:27:17 PM	0.07	353	0.05	1.0	18.2	34.6
16-Jun-21 10:28:18 PM	0.07	352	0.05	0.9	18.1	34.7
16-Jun-21 10:29:19 PM	0.07	354	0.05	1.0	18.2	34.7
16-Jun-21 10:30:20 PM	0.07	352	0.06	1.0	18.2	34.7
16-Jun-21 10:31:21 PM	0.07	352	0.05	1.0	18.1	34.6
16-Jun-21 10:32:22 PM	0.07	357	0.05	1.0	18.2	34.5
16-Jun-21 10:33:23 PM	0.07	354	0.05	1.0	18.2	34.5
16-Jun-21 10:34:24 PM	0.07	356	0.05	1.0	18.2	34.5
16-Jun-21 10:35:25 PM	0.07	357	0.05	1.0	18.1	34.5
16-Jun-21 10:36:26 PM	0.07	355	0.05	1.0	18.1	34.5
16-Jun-21 10:37:27 PM	0.07	354	0.05	1.0	18.2	34.5
16-Jun-21 10:38:28 PM	0.07	357	0.05	1.0	18.1	34.5
16-Jun-21 10:39:29 PM	0.07	355	0.05	1.0	18.2	34.5
16-Jun-21 10:40:30 PM	0.07	357	0.05	1.0	18.1	34.4
16-Jun-21 10:41:31 PM	0.07	357	0.05	1.0	18.2	34.5
16-Jun-21 10:42:32 PM	0.07	357	0.05	1.0	18.2	34.4
16-Jun-21 10:43:33 PM	0.07	359	0.05	1.0	18.1	34.3
16-Jun-21 10:44:34 PM	0.07	356	0.05	1.0	18.1	34.4
16-Jun-21 10:45:35 PM	0.07	358	0.05	1.0	18.0	34.4
16-Jun-21 10:46:36 PM	0.07	357	0.05	1.0	18.1	34.5
16-Jun-21 10:47:37 PM	0.07	355	0.05	1.0	18.1	34.4
16-Jun-21 10:48:38 PM	0.07	356	0.05	1.0	18.1	34.4

16-Jun-21 10:49:39 PM	0.07	355	0.05	1.0	18.0	34.4
16-Jun-21 10:50:40 PM	0.07	355	0.05	1.0	18.1	34.4
16-Jun-21 10:51:41 PM	0.07	357	0.05	1.0	18.1	34.3
16-Jun-21 10:52:42 PM	0.07	356	0.05	1.0	18.1	34.2
16-Jun-21 10:53:43 PM	0.07	355	0.05	1.0	18.0	34.2
16-Jun-21 10:54:44 PM	0.07	358	0.05	1.0	18.0	34.1
16-Jun-21 10:55:45 PM	0.07	355	0.05	1.0	18.1	34.1
16-Jun-21 10:56:46 PM	0.07	354	0.05	1.0	18.0	34.1
16-Jun-21 10:57:47 PM	0.07	356	0.05	1.0	18.0	34.1
16-Jun-21 10:58:48 PM	0.07	357	0.05	1.0	18.0	34.0
16-Jun-21 10:59:49 PM	0.07	357	0.05	1.0	18.0	34.0
16-Jun-21 11:00:50 PM	0.07	356	0.05	1.0	18.0	34.0
16-Jun-21 11:01:51 PM	0.07	358	0.05	1.0	18.1	34.0
16-Jun-21 11:02:52 PM	0.07	356	0.05	0.9	18.0	33.9
16-Jun-21 11:03:53 PM	0.07	355	0.05	1.0	18.0	33.9
16-Jun-21 11:04:54 PM	0.07	357	0.05	0.9	18.0	33.9
16-Jun-21 11:05:55 PM	0.07	360	0.05	0.9	18.0	33.8
16-Jun-21 11:06:56 PM	0.07	358	0.06	1.0	17.9	33.8
16-Jun-21 11:07:57 PM	0.07	356	0.06	1.0	17.9	33.8
16-Jun-21 11:08:58 PM	0.07	359	0.05	0.9	17.9	33.9
16-Jun-21 11:09:59 PM	0.07	359	0.05	0.9	17.9	33.9
16-Jun-21 11:11:00 PM	0.07	358	0.05	0.9	17.8	33.9
16-Jun-21 11:12:01 PM	0.07	358	0.06	0.9	17.9	34.0
16-Jun-21 11:13:02 PM	0.07	357	0.05	0.9	17.9	34.0
16-Jun-21 11:14:03 PM	0.07	356	0.06	0.9	17.9	33.9
16-Jun-21 11:15:04 PM	0.07	357	0.05	0.9	17.9	33.8
16-Jun-21 11:16:05 PM	0.07	356	0.05	0.9	17.9	33.8
16-Jun-21 11:17:06 PM	0.07	357	0.05	0.9	17.8	33.8
16-Jun-21 11:18:07 PM	0.07	356	0.05	0.9	17.9	33.8
16-Jun-21 11:19:08 PM	0.07	356	0.05	0.9	17.8	33.8
16-Jun-21 11:20:09 PM	0.07	355	0.07	0.9	17.8	33.9
16-Jun-21 11:21:10 PM	0.07	347	0.07	0.9	17.8	33.9
16-Jun-21 11:22:11 PM	0.07	347	0.07	0.9	17.8	34.0
16-Jun-21 11:23:12 PM	0.07	347	0.07	0.9	17.8	34.0
16-Jun-21 11:24:13 PM	0.07	343	0.07	0.9	17.9	34.0
16-Jun-21 11:25:14 PM	0.07	344	0.07	0.9	17.9	34.0
16-Jun-21 11:26:15 PM	0.07	348	0.07	0.9	17.8	33.9
16-Jun-21 11:27:16 PM	0.07	345	0.07	0.9	17.8	34.0
16-Jun-21 11:28:17 PM	0.07	345	0.07	0.9	17.8	34.0
16-Jun-21 11:29:18 PM	0.07	348	0.07	0.9	17.7	34.0
16-Jun-21 11:30:19 PM	0.07	346	0.08	0.9	17.8	34.1
16-Jun-21 11:31:20 PM	0.07	347	0.07	0.9	17.8	34.1
16-Jun-21 11:32:21 PM	0.07	344	0.07	0.9	17.8	34.0
16-Jun-21 11:33:22 PM	0.07	347	0.07	0.9	17.8	34.0
16-Jun-21 11:34:23 PM	0.07	348	0.07	0.9	17.8	34.0
16-Jun-21 11:35:24 PM	0.07	345	0.07	0.9	17.9	33.9
16-Jun-21 11:36:25 PM	0.07	348	0.07	1.0	17.8	33.9
16-Jun-21 11:37:26 PM	0.07	347	0.07	1.0	17.8	33.8
16-Jun-21 11:38:27 PM	0.07	347	0.07	1.0	17.8	33.9
16-Jun-21 11:39:28 PM	0.07	348	0.07	1.0	17.8	34.0
16-Jun-21 11:40:29 PM	0.07	348	0.07	1.0	17.8	33.9
16-Jun-21 11:41:30 PM	0.07	346	0.07	1.0	17.7	33.9
16-Jun-21 11:42:31 PM	0.07	347	0.07	1.0	17.8	34.0
16-Jun-21 11:43:32 PM	0.07	347	0.07	1.0	17.7	33.9
16-Jun-21 11:44:33 PM	0.07	347	0.07	1.0	17.7	33.9
16-Jun-21 11:45:34 PM	0.07	349	0.07	1.0	17.7	34.0
16-Jun-21 11:46:35 PM	0.07	350	0.07	0.9	17.7	33.9

16-Jun-21 11:47:36 PM	0.07	347	0.07	0.9	17.7	33.9
16-Jun-21 11:48:37 PM	0.07	347	0.07	0.9	17.7	34.0
16-Jun-21 11:49:38 PM	0.07	348	0.07	1.0	17.7	33.9
16-Jun-21 11:50:39 PM	0.07	347	0.07	1.0	17.7	33.9
16-Jun-21 11:51:40 PM	0.07	348	0.07	1.0	17.6	33.9
16-Jun-21 11:52:41 PM	0.07	347	0.07	1.0	17.7	33.8
16-Jun-21 11:53:42 PM	0.07	347	0.07	1.0	17.7	33.8
16-Jun-21 11:54:43 PM	0.07	348	0.07	1.0	17.7	33.8
16-Jun-21 11:55:44 PM	0.07	347	0.07	1.0	17.6	33.8
16-Jun-21 11:56:45 PM	0.07	351	0.07	1.0	17.6	33.8
16-Jun-21 11:57:46 PM	0.07	348	0.07	1.0	17.5	33.8
16-Jun-21 11:58:47 PM	0.07	347	0.07	1.0	17.6	33.9
16-Jun-21 11:59:48 PM	0.07	345	0.07	0.9	17.6	33.9
17-Jun-21 12:00:49 AM	0.07	350	0.07	0.9	17.6	33.8
17-Jun-21 12:01:50 AM	0.07	349	0.07	1.0	17.6	33.7
17-Jun-21 12:02:51 AM	0.07	345	0.07	1.0	17.6	33.7
17-Jun-21 12:03:52 AM	0.07	346	0.07	1.0	17.6	33.7
17-Jun-21 12:04:53 AM	0.07	347	0.07	1.0	17.6	33.7
17-Jun-21 12:05:54 AM	0.07	344	0.07	1.0	17.6	33.7
17-Jun-21 12:06:55 AM	0.07	349	0.07	1.0	17.5	33.7
17-Jun-21 12:07:56 AM	0.07	346	0.07	1.0	17.5	33.7
17-Jun-21 12:08:57 AM	0.07	347	0.07	0.9	17.5	33.8
17-Jun-21 12:09:58 AM	0.07	346	0.07	1.0	17.5	33.8
17-Jun-21 12:10:59 AM	0.07	345	0.07	0.9	17.6	33.7
17-Jun-21 12:12:00 AM	0.07	348	0.07	0.9	17.5	33.7
17-Jun-21 12:13:01 AM	0.07	345	0.07	0.9	17.5	33.6
17-Jun-21 12:14:02 AM	0.07	349	0.07	1.0	17.5	33.6
17-Jun-21 12:15:03 AM	0.07	345	0.07	1.0	17.5	33.6
17-Jun-21 12:16:04 AM	0.07	346	0.07	0.9	17.6	33.6
17-Jun-21 12:17:05 AM	0.07	347	0.07	0.9	17.6	33.5
17-Jun-21 12:18:06 AM	0.07	348	0.07	0.9	17.5	33.5
17-Jun-21 12:19:07 AM	0.07	348	0.07	0.9	17.5	33.4
17-Jun-21 12:20:08 AM	0.07	347	0.07	0.9	17.5	33.4
17-Jun-21 12:21:09 AM	0.07	346	0.07	1.0	17.5	33.4
17-Jun-21 12:22:10 AM	0.07	346	0.07	0.9	17.4	33.4
17-Jun-21 12:23:11 AM	0.07	345	0.07	0.9	17.4	33.4
17-Jun-21 12:24:12 AM	0.07	347	0.07	0.9	17.5	33.4
17-Jun-21 12:25:13 AM	0.07	348	0.07	0.9	17.5	33.4
17-Jun-21 12:26:14 AM	0.07	343	0.07	0.9	17.4	33.3
17-Jun-21 12:27:15 AM	0.07	344	0.06	0.9	17.4	33.3
17-Jun-21 12:28:16 AM	0.07	347	0.06	0.9	17.5	33.3
17-Jun-21 12:29:17 AM	0.07	346	0.07	0.9	17.4	33.3
17-Jun-21 12:30:18 AM	0.07	346	0.07	0.9	17.4	33.3
17-Jun-21 12:31:19 AM	0.07	345	0.07	0.9	17.4	33.3
17-Jun-21 12:32:20 AM	0.07	348	0.07	0.9	17.4	33.3
17-Jun-21 12:33:21 AM	0.07	346	0.07	0.9	17.3	33.3
17-Jun-21 12:34:22 AM	0.07	343	0.07	0.9	17.3	33.4
17-Jun-21 12:35:23 AM	0.07	343	0.07	0.9	17.3	33.4
17-Jun-21 12:36:24 AM	0.07	344	0.07	0.9	17.3	33.4
17-Jun-21 12:37:25 AM	0.07	345	0.07	0.9	17.3	33.4
17-Jun-21 12:38:26 AM	0.07	341	0.06	0.9	17.3	33.4
17-Jun-21 12:39:27 AM	0.07	343	0.07	0.9	17.3	33.3
17-Jun-21 12:40:28 AM	0.07	343	0.07	0.9	17.3	33.3
17-Jun-21 12:41:29 AM	0.07	340	0.07	0.9	17.3	33.3
17-Jun-21 12:42:30 AM	0.07	343	0.07	0.9	17.3	33.2
17-Jun-21 12:43:31 AM	0.07	345	0.07	0.9	17.3	33.2
17-Jun-21 12:44:32 AM	0.07	344	0.07	0.9	17.3	33.3

17-Jun-21 12:45:33 AM	0.07	341	0.07	0.9	17.3	33.2
17-Jun-21 12:46:34 AM	0.07	343	0.06	0.9	17.3	33.2
17-Jun-21 12:47:35 AM	0.07	343	0.06	0.9	17.3	33.2
17-Jun-21 12:48:36 AM	0.07	343	0.07	0.9	17.3	33.2
17-Jun-21 12:49:37 AM	0.07	344	0.06	0.9	17.3	33.1
17-Jun-21 12:50:38 AM	0.07	345	0.06	0.9	17.2	33.1
17-Jun-21 12:51:39 AM	0.07	342	0.06	0.9	17.1	33.1
17-Jun-21 12:52:40 AM	0.07	342	0.06	0.9	17.1	33.1
17-Jun-21 12:53:41 AM	0.07	342	0.06	0.9	17.1	33.2
17-Jun-21 12:54:42 AM	0.07	341	0.06	0.9	17.2	33.2
17-Jun-21 12:55:43 AM	0.07	342	0.06	0.9	17.3	33.1
17-Jun-21 12:56:44 AM	0.07	341	0.06	0.9	17.2	33.0
17-Jun-21 12:57:45 AM	0.07	342	0.06	0.9	17.2	33.0
17-Jun-21 12:58:46 AM	0.07	342	0.06	0.9	17.2	33.0
17-Jun-21 12:59:47 AM	0.07	342	0.06	0.9	17.2	32.9
17-Jun-21 01:00:48 AM	0.07	341	0.06	0.9	17.2	32.9
17-Jun-21 01:01:49 AM	0.07	345	0.06	0.9	17.1	32.8
17-Jun-21 01:02:50 AM	0.07	343	0.06	0.9	17.1	32.8
17-Jun-21 01:03:51 AM	0.07	342	0.06	0.9	17.0	32.8
17-Jun-21 01:04:52 AM	0.07	341	0.06	0.9	17.1	32.9
17-Jun-21 01:05:53 AM	0.07	340	0.06	0.9	17.2	32.9
17-Jun-21 01:06:54 AM	0.07	342	0.06	0.9	17.1	32.8
17-Jun-21 01:07:55 AM	0.07	342	0.06	0.9	17.1	32.8
17-Jun-21 01:08:56 AM	0.07	340	0.06	0.9	17.1	32.7
17-Jun-21 01:09:57 AM	0.07	341	0.06	0.9	17.1	32.7
17-Jun-21 01:10:58 AM	0.07	342	0.06	0.9	17.1	32.7
17-Jun-21 01:11:59 AM	0.07	342	0.06	0.9	17.1	32.6
17-Jun-21 01:13:00 AM	0.07	343	0.06	0.9	17.1	32.7
17-Jun-21 01:14:01 AM	0.07	341	0.06	0.9	17.0	32.6
17-Jun-21 01:15:02 AM	0.07	340	0.06	0.9	17.1	32.6
17-Jun-21 01:16:03 AM	0.07	340	0.06	0.9	16.9	32.6
17-Jun-21 01:17:04 AM	0.07	339	0.06	0.9	17.0	32.7
17-Jun-21 01:18:05 AM	0.07	341	0.06	0.9	17.0	32.7
17-Jun-21 01:19:06 AM	0.07	340	0.06	0.9	17.0	32.7
17-Jun-21 01:20:07 AM	0.07	338	0.06	0.9	17.0	32.7
17-Jun-21 01:21:08 AM	0.07	338	0.06	0.9	17.0	32.7
17-Jun-21 01:22:09 AM	0.07	339	0.06	0.9	16.9	32.6
17-Jun-21 01:23:10 AM	0.07	338	0.06	0.9	17.0	32.6
17-Jun-21 01:24:11 AM	0.07	340	0.06	0.9	17.0	32.6
17-Jun-21 01:25:12 AM	0.07	341	0.06	0.9	17.0	32.6
17-Jun-21 01:26:13 AM	0.07	341	0.06	0.9	17.0	32.6
17-Jun-21 01:27:14 AM	0.07	341	0.06	0.9	16.9	32.5
17-Jun-21 01:28:15 AM	0.07	337	0.06	0.9	16.9	32.6
17-Jun-21 01:29:16 AM	0.07	338	0.06	0.9	16.9	32.6
17-Jun-21 01:30:17 AM	0.07	339	0.06	0.9	17.0	32.5
17-Jun-21 01:31:18 AM	0.07	338	0.06	0.9	17.0	32.5
17-Jun-21 01:32:19 AM	0.07	336	0.06	0.9	16.9	32.5
17-Jun-21 01:33:20 AM	0.07	338	0.06	0.9	16.9	32.5
17-Jun-21 01:34:21 AM	0.07	340	0.06	0.9	16.9	32.5
17-Jun-21 01:35:22 AM	0.07	341	0.06	0.9	16.9	32.6
17-Jun-21 01:36:23 AM	0.07	337	0.06	0.9	16.9	32.6
17-Jun-21 01:37:24 AM	0.07	337	0.06	0.9	16.9	32.5
17-Jun-21 01:38:25 AM	0.07	337	0.06	0.9	16.8	32.5
17-Jun-21 01:39:26 AM	0.07	337	0.06	0.9	16.8	32.5
17-Jun-21 01:40:27 AM	0.07	336	0.06	0.9	16.8	32.6
17-Jun-21 01:41:28 AM	0.07	337	0.06	0.8	16.8	32.6
17-Jun-21 01:42:29 AM	0.07	337	0.06	0.9	16.8	32.6

17-Jun-21 01:43:30 AM	0.07	337	0.06	0.9	16.8	32.6
17-Jun-21 01:44:31 AM	0.07	336	0.06	0.9	16.8	32.6
17-Jun-21 01:45:32 AM	0.07	340	0.06	0.9	16.8	32.6
17-Jun-21 01:46:33 AM	0.07	339	0.06	0.9	16.8	32.6
17-Jun-21 01:47:34 AM	0.07	340	0.06	0.9	16.8	32.6
17-Jun-21 01:48:35 AM	0.07	337	0.06	0.9	16.7	32.6
17-Jun-21 01:49:36 AM	0.07	338	0.06	0.9	16.7	32.7
17-Jun-21 01:50:37 AM	0.07	338	0.06	0.8	16.7	32.7
17-Jun-21 01:51:38 AM	0.07	336	0.06	0.8	16.8	32.8
17-Jun-21 01:52:39 AM	0.07	336	0.06	0.8	16.7	32.7
17-Jun-21 01:53:40 AM	0.07	336	0.06	0.8	16.8	32.7
17-Jun-21 01:54:41 AM	0.07	336	0.06	0.9	16.7	32.7
17-Jun-21 01:55:42 AM	0.07	332	0.06	0.9	16.7	32.8
17-Jun-21 01:56:43 AM	0.07	334	0.06	0.8	16.8	32.8
17-Jun-21 01:57:44 AM	0.07	338	0.06	0.8	16.8	32.8
17-Jun-21 01:58:45 AM	0.07	337	0.06	0.8	16.7	32.7
17-Jun-21 01:59:46 AM	0.07	335	0.06	0.9	16.7	32.7
17-Jun-21 02:00:47 AM	0.07	337	0.06	0.9	16.7	32.8
17-Jun-21 02:01:48 AM	0.07	335	0.06	0.9	16.8	32.8
17-Jun-21 02:02:49 AM	0.07	336	0.06	0.9	16.7	32.8
17-Jun-21 02:03:50 AM	0.07	336	0.06	0.9	16.7	32.8
17-Jun-21 02:04:51 AM	0.07	337	0.06	0.9	16.7	32.8
17-Jun-21 02:05:52 AM	0.07	334	0.06	0.9	16.7	32.8
17-Jun-21 02:06:53 AM	0.07	334	0.06	0.9	16.7	32.8
17-Jun-21 02:07:54 AM	0.07	335	0.07	0.9	16.7	32.8
17-Jun-21 02:08:55 AM	0.07	337	0.06	0.9	16.6	32.9
17-Jun-21 02:09:56 AM	0.07	335	0.07	0.9	16.7	33.0
17-Jun-21 02:10:57 AM	0.07	335	0.06	0.8	16.7	33.0
17-Jun-21 02:11:58 AM	0.07	333	0.06	0.8	16.7	32.9
17-Jun-21 02:12:59 AM	0.07	334	0.06	0.9	16.6	32.9
17-Jun-21 02:14:00 AM	0.07	335	0.06	0.9	16.7	33.0
17-Jun-21 02:15:01 AM	0.07	335	0.06	0.8	16.7	33.0
17-Jun-21 02:16:02 AM	0.07	334	0.06	0.9	16.6	32.9
17-Jun-21 02:17:03 AM	0.07	335	0.06	0.9	16.6	33.0
17-Jun-21 02:18:04 AM	0.07	333	0.06	0.9	16.6	33.0
17-Jun-21 02:19:05 AM	0.07	334	0.06	0.9	16.7	33.0
17-Jun-21 02:20:06 AM	0.07	335	0.06	0.9	16.6	33.0
17-Jun-21 02:21:07 AM	0.07	335	0.06	0.9	16.6	33.0
17-Jun-21 02:22:08 AM	0.07	335	0.06	0.9	16.6	33.1
17-Jun-21 02:23:09 AM	0.07	335	0.06	0.8	16.6	33.1
17-Jun-21 02:24:10 AM	0.07	335	0.06	0.9	16.6	33.1
17-Jun-21 02:25:11 AM	0.07	334	0.06	0.9	16.6	33.1
17-Jun-21 02:26:12 AM	0.07	335	0.06	0.8	16.6	33.1
17-Jun-21 02:27:13 AM	0.07	336	0.06	0.9	16.6	33.1
17-Jun-21 02:28:14 AM	0.07	334	0.06	0.9	16.6	33.2
17-Jun-21 02:29:15 AM	0.07	334	0.06	0.9	16.7	33.2
17-Jun-21 02:30:16 AM	0.07	335	0.06	0.9	16.7	33.1
17-Jun-21 02:31:17 AM	0.07	336	0.06	0.9	16.6	33.1
17-Jun-21 02:32:18 AM	0.07	338	0.06	0.8	16.7	33.1
17-Jun-21 02:33:19 AM	0.07	336	0.06	0.9	16.6	33.1
17-Jun-21 02:34:20 AM	0.07	336	0.06	0.9	16.5	33.1
17-Jun-21 02:35:21 AM	0.07	334	0.06	0.9	16.6	33.1
17-Jun-21 02:36:22 AM	0.07	335	0.06	0.9	16.5	33.2
17-Jun-21 02:37:23 AM	0.07	336	0.06	0.9	16.5	33.2
17-Jun-21 02:38:24 AM	0.07	335	0.06	0.8	16.5	33.2
17-Jun-21 02:39:25 AM	0.07	335	0.06	0.8	16.6	33.3
17-Jun-21 02:40:26 AM	0.07	335	0.06	0.8	16.6	33.3

17-Jun-21 02:41:27 AM	0.07	337	0.06	0.9	16.6	33.2
17-Jun-21 02:42:28 AM	0.07	335	0.06	0.9	16.6	33.3
17-Jun-21 02:43:29 AM	0.07	336	0.06	0.8	16.6	33.3
17-Jun-21 02:44:30 AM	0.07	335	0.06	0.9	16.4	33.3
17-Jun-21 02:45:31 AM	0.07	336	0.06	0.8	16.5	33.4
17-Jun-21 02:46:32 AM	0.07	335	0.06	0.8	16.5	33.5
17-Jun-21 02:47:33 AM	0.07	335	0.06	0.8	16.4	33.4
17-Jun-21 02:48:34 AM	0.07	334	0.06	0.8	16.5	33.4
17-Jun-21 02:49:35 AM	0.07	336	0.06	0.8	16.4	33.5
17-Jun-21 02:50:36 AM	0.07	336	0.06	0.8	16.4	33.5
17-Jun-21 02:51:37 AM	0.07	333	0.06	0.8	16.4	33.6
17-Jun-21 02:52:38 AM	0.07	333	0.06	0.8	16.4	33.6
17-Jun-21 02:53:39 AM	0.07	331	0.06	0.8	16.5	33.6
17-Jun-21 02:54:40 AM	0.07	333	0.06	0.8	16.4	33.6
17-Jun-21 02:55:41 AM	0.07	333	0.07	0.8	16.4	33.6
17-Jun-21 02:56:42 AM	0.07	331	0.06	0.8	16.4	33.6
17-Jun-21 02:57:43 AM	0.07	335	0.06	0.8	16.5	33.6
17-Jun-21 02:58:44 AM	0.07	331	0.06	0.8	16.5	33.6
17-Jun-21 02:59:45 AM	0.07	335	0.06	0.8	16.5	33.6
17-Jun-21 03:00:46 AM	0.07	331	0.06	0.9	16.4	33.6
17-Jun-21 03:01:47 AM	0.07	334	0.06	0.9	16.5	33.6
17-Jun-21 03:02:48 AM	0.07	334	0.06	0.8	16.5	33.6
17-Jun-21 03:03:49 AM	0.07	333	0.06	0.9	16.4	33.6
17-Jun-21 03:04:50 AM	0.07	333	0.06	0.9	16.4	33.6
17-Jun-21 03:05:51 AM	0.07	335	0.06	0.9	16.5	33.7
17-Jun-21 03:06:52 AM	0.07	336	0.06	0.9	16.5	33.7
17-Jun-21 03:07:53 AM	0.07	334	0.07	0.9	16.5	33.8
17-Jun-21 03:08:54 AM	0.07	333	0.06	0.9	16.4	33.7
17-Jun-21 03:09:55 AM	0.07	334	0.06	0.8	16.4	33.7
17-Jun-21 03:10:56 AM	0.07	335	0.06	0.9	16.4	33.7
17-Jun-21 03:11:57 AM	0.07	334	0.07	0.8	16.4	33.8
17-Jun-21 03:12:58 AM	0.07	334	0.06	0.9	16.4	33.7
17-Jun-21 03:13:59 AM	0.07	334	0.06	0.9	16.4	33.8
17-Jun-21 03:15:00 AM	0.07	335	0.07	0.9	16.3	33.8
17-Jun-21 03:16:01 AM	0.07	332	0.06	0.8	16.4	33.8
17-Jun-21 03:17:02 AM	0.07	336	0.07	0.8	16.4	33.8
17-Jun-21 03:18:03 AM	0.07	334	0.07	0.8	16.4	33.8
17-Jun-21 03:19:04 AM	0.07	335	0.06	0.8	16.4	33.9
17-Jun-21 03:20:05 AM	0.07	334	0.07	0.9	16.3	33.8
17-Jun-21 03:21:06 AM	0.07	334	0.07	0.9	16.3	33.9
17-Jun-21 03:22:07 AM	0.07	332	0.07	0.8	16.4	33.9
17-Jun-21 03:23:08 AM	0.07	335	0.07	0.8	16.4	33.9
17-Jun-21 03:24:09 AM	0.07	331	0.07	0.8	16.3	33.9
17-Jun-21 03:25:10 AM	0.07	334	0.07	0.8	16.4	33.9
17-Jun-21 03:26:11 AM	0.07	335	0.07	0.8	16.3	33.9
17-Jun-21 03:27:12 AM	0.07	333	0.07	0.8	16.3	33.9
17-Jun-21 03:28:13 AM	0.07	330	0.07	0.8	16.3	33.9
17-Jun-21 03:29:14 AM	0.07	331	0.07	0.8	16.3	34.0
17-Jun-21 03:30:15 AM	0.07	334	0.07	0.8	16.3	34.0
17-Jun-21 03:31:16 AM	0.07	336	0.07	0.8	16.3	34.0
17-Jun-21 03:32:17 AM	0.07	333	0.07	0.8	16.3	33.9
17-Jun-21 03:33:18 AM	0.07	333	0.07	0.8	16.3	33.9
17-Jun-21 03:34:19 AM	0.07	332	0.07	0.8	16.3	33.9
17-Jun-21 03:35:20 AM	0.07	335	0.07	0.8	16.2	33.9
17-Jun-21 03:36:21 AM	0.07	335	0.07	0.8	16.3	34.0
17-Jun-21 03:37:22 AM	0.07	334	0.07	0.8	16.3	34.0
17-Jun-21 03:38:23 AM	0.07	334	0.07	0.8	16.3	33.9

17-Jun-21 03:39:24 AM	0.07	334	0.07	0.8	16.3	33.9
17-Jun-21 03:40:25 AM	0.07	334	0.07	0.8	16.3	33.9
17-Jun-21 03:41:26 AM	0.07	333	0.07	0.8	16.3	33.9
17-Jun-21 03:42:27 AM	0.07	333	0.07	0.8	16.3	33.9
17-Jun-21 03:43:28 AM	0.07	334	0.07	0.8	16.3	33.9
17-Jun-21 03:44:29 AM	0.07	335	0.07	0.8	16.3	33.9
17-Jun-21 03:45:30 AM	0.07	335	0.07	0.8	16.2	33.8
17-Jun-21 03:46:31 AM	0.07	334	0.07	0.9	16.2	33.9
17-Jun-21 03:47:32 AM	0.07	333	0.07	0.8	16.3	33.9
17-Jun-21 03:48:33 AM	0.07	334	0.07	0.8	16.2	33.8
17-Jun-21 03:49:34 AM	0.07	332	0.07	0.9	16.2	33.9
17-Jun-21 03:50:35 AM	0.07	334	0.07	0.8	16.2	33.9
17-Jun-21 03:51:36 AM	0.07	334	0.07	0.8	16.2	33.9
17-Jun-21 03:52:37 AM	0.07	334	0.07	0.8	16.2	33.9
17-Jun-21 03:53:38 AM	0.07	335	0.07	0.9	16.2	33.8
17-Jun-21 03:54:39 AM	0.07	335	0.07	0.9	16.2	33.8
17-Jun-21 03:55:40 AM	0.07	333	0.07	0.9	16.1	33.8
17-Jun-21 03:56:41 AM	0.07	335	0.07	0.9	16.2	33.8
17-Jun-21 03:57:42 AM	0.07	333	0.07	0.8	16.2	33.9
17-Jun-21 03:58:43 AM	0.07	333	0.07	0.8	16.2	33.9
17-Jun-21 03:59:44 AM	0.07	334	0.07	0.8	16.2	33.8
17-Jun-21 04:00:45 AM	0.07	335	0.07	0.8	16.2	33.8
17-Jun-21 04:01:46 AM	0.07	333	0.07	0.8	16.1	33.8
17-Jun-21 04:02:47 AM	0.07	334	0.07	0.8	16.2	33.8
17-Jun-21 04:03:48 AM	0.07	335	0.07	0.8	16.1	33.8
17-Jun-21 04:04:49 AM	0.07	336	0.07	0.8	16.1	33.9
17-Jun-21 04:05:50 AM	0.07	335	0.07	0.9	16.1	33.9
17-Jun-21 04:06:51 AM	0.07	333	0.07	0.8	16.1	33.9
17-Jun-21 04:07:52 AM	0.07	333	0.07	0.8	16.1	34.0
17-Jun-21 04:08:53 AM	0.07	333	0.07	0.8	16.1	34.0
17-Jun-21 04:09:54 AM	0.07	333	0.07	0.8	16.0	34.0
17-Jun-21 04:10:55 AM	0.07	331	0.06	0.8	16.0	34.0
17-Jun-21 04:11:56 AM	0.07	335	0.07	0.8	16.1	34.0
17-Jun-21 04:12:57 AM	0.07	333	0.07	0.8	16.0	33.9
17-Jun-21 04:13:58 AM	0.07	333	0.07	0.8	16.1	34.0
17-Jun-21 04:14:59 AM	0.07	332	0.07	0.8	16.0	34.0
17-Jun-21 04:16:00 AM	0.07	333	0.07	0.8	16.0	34.0
17-Jun-21 04:17:01 AM	0.07	333	0.07	0.8	16.1	34.0
17-Jun-21 04:18:02 AM	0.07	333	0.07	0.8	16.1	34.0
17-Jun-21 04:19:03 AM	0.07	335	0.07	0.8	16.0	34.0
17-Jun-21 04:20:04 AM	0.07	333	0.07	0.8	16.0	34.0
17-Jun-21 04:21:05 AM	0.07	331	0.07	0.8	16.1	34.0
17-Jun-21 04:22:06 AM	0.07	333	0.07	0.8	16.0	34.0
17-Jun-21 04:23:07 AM	0.07	332	0.07	0.8	16.0	34.1
17-Jun-21 04:24:08 AM	0.07	333	0.07	0.8	16.0	34.1
17-Jun-21 04:25:09 AM	0.07	333	0.07	0.8	16.0	34.1
17-Jun-21 04:26:10 AM	0.07	333	0.07	0.8	16.0	34.1
17-Jun-21 04:27:11 AM	0.07	331	0.07	0.8	15.9	34.1
17-Jun-21 04:28:12 AM	0.07	332	0.07	0.8	15.9	34.2
17-Jun-21 04:29:13 AM	0.07	332	0.07	0.8	16.1	34.2
17-Jun-21 04:30:14 AM	0.07	333	0.07	0.8	16.0	34.2
17-Jun-21 04:31:15 AM	0.07	333	0.07	0.8	16.0	34.1
17-Jun-21 04:32:16 AM	0.07	333	0.07	0.8	15.9	34.1
17-Jun-21 04:33:17 AM	0.07	335	0.07	0.9	16.0	34.1
17-Jun-21 04:34:18 AM	0.07	332	0.07	0.8	16.0	34.1
17-Jun-21 04:35:19 AM	0.07	332	0.07	0.8	16.0	34.1
17-Jun-21 04:36:20 AM	0.07	334	0.07	0.8	16.0	34.0

17-Jun-21 04:37:21 AM	0.07	332	0.07	0.8	16.0	34.0
17-Jun-21 04:38:22 AM	0.07	331	0.07	0.8	16.0	34.0
17-Jun-21 04:39:23 AM	0.07	333	0.07	0.8	16.0	34.0
17-Jun-21 04:40:24 AM	0.07	334	0.07	0.8	15.9	34.0
17-Jun-21 04:41:25 AM	0.07	334	0.07	0.8	16.0	34.0
17-Jun-21 04:42:26 AM	0.07	332	0.07	0.9	16.0	33.9
17-Jun-21 04:43:27 AM	0.07	333	0.07	0.8	15.9	33.9
17-Jun-21 04:44:28 AM	0.07	333	0.07	0.8	15.9	34.0
17-Jun-21 04:45:29 AM	0.07	332	0.07	0.8	16.0	34.0
17-Jun-21 04:46:30 AM	0.07	329	0.07	0.8	16.0	34.0
17-Jun-21 04:47:31 AM	0.07	334	0.07	0.8	15.9	34.0
17-Jun-21 04:48:32 AM	0.07	334	0.07	0.8	15.9	34.0
17-Jun-21 04:49:33 AM	0.07	332	0.07	0.8	15.9	34.0
17-Jun-21 04:50:34 AM	0.07	334	0.07	0.8	15.9	34.0
17-Jun-21 04:51:35 AM	0.07	332	0.06	0.8	15.9	34.0
17-Jun-21 04:52:36 AM	0.07	332	0.07	0.8	15.8	33.9
17-Jun-21 04:53:37 AM	0.07	330	0.07	0.8	15.9	34.0
17-Jun-21 04:54:38 AM	0.07	334	0.07	0.8	15.9	33.9
17-Jun-21 04:55:39 AM	0.07	335	0.06	0.8	15.9	33.9
17-Jun-21 04:56:40 AM	0.07	333	0.07	0.8	15.9	33.9
17-Jun-21 04:57:41 AM	0.07	332	0.07	0.8	15.8	33.9
17-Jun-21 04:58:42 AM	0.07	331	0.07	0.8	15.8	33.9
17-Jun-21 04:59:43 AM	0.07	331	0.07	0.8	15.9	33.9
17-Jun-21 05:00:44 AM	0.07	331	0.07	0.8	15.8	33.9
17-Jun-21 05:01:45 AM	0.07	330	0.07	0.8	15.9	33.9
17-Jun-21 05:02:46 AM	0.07	331	0.07	0.8	15.9	33.9
17-Jun-21 05:03:47 AM	0.07	332	0.07	0.8	15.9	33.8
17-Jun-21 05:04:48 AM	0.07	333	0.07	0.8	15.9	33.7
17-Jun-21 05:05:49 AM	0.07	331	0.07	0.8	15.9	33.7
17-Jun-21 05:06:50 AM	0.07	330	0.07	0.8	15.9	33.7
17-Jun-21 05:07:51 AM	0.07	332	0.07	0.8	15.8	33.7
17-Jun-21 05:08:52 AM	0.07	330	0.07	0.8	15.9	33.7
17-Jun-21 05:09:53 AM	0.07	329	0.07	0.9	15.8	33.7
17-Jun-21 05:10:54 AM	0.07	333	0.07	0.9	15.8	33.7
17-Jun-21 05:11:55 AM	0.07	331	0.07	0.8	15.8	33.7
17-Jun-21 05:12:56 AM	0.07	331	0.07	0.8	15.8	33.8
17-Jun-21 05:13:57 AM	0.07	330	0.07	0.8	15.8	33.7
17-Jun-21 05:14:58 AM	0.07	332	0.07	0.8	15.8	33.8
17-Jun-21 05:15:59 AM	0.07	330	0.07	0.8	15.8	33.8
17-Jun-21 05:17:00 AM	0.07	332	0.07	0.8	15.8	33.8
17-Jun-21 05:18:01 AM	0.07	329	0.07	0.8	15.8	33.8
17-Jun-21 05:19:02 AM	0.07	331	0.07	0.8	15.8	33.7
17-Jun-21 05:20:03 AM	0.07	330	0.07	0.8	15.7	33.8
17-Jun-21 05:21:04 AM	0.07	330	0.07	0.8	15.7	33.8
17-Jun-21 05:22:05 AM	0.07	330	0.07	0.8	15.7	33.9
17-Jun-21 05:23:06 AM	0.07	328	0.07	0.8	15.7	33.9
17-Jun-21 05:24:07 AM	0.07	330	0.07	0.8	15.7	33.8
17-Jun-21 05:25:08 AM	0.07	330	0.07	0.8	15.7	33.9
17-Jun-21 05:26:09 AM	0.07	329	0.07	0.8	15.7	33.9
17-Jun-21 05:27:10 AM	0.07	330	0.07	0.8	15.7	33.9
17-Jun-21 05:28:11 AM	0.07	331	0.07	0.8	15.6	33.8
17-Jun-21 05:29:12 AM	0.07	329	0.07	0.8	15.7	33.9
17-Jun-21 05:30:13 AM	0.07	326	0.07	0.8	15.7	33.8
17-Jun-21 05:31:14 AM	0.07	329	0.07	0.8	15.7	33.9
17-Jun-21 05:32:15 AM	0.07	331	0.07	0.8	15.7	33.8
17-Jun-21 05:33:16 AM	0.07	329	0.07	0.8	15.7	33.8
17-Jun-21 05:34:17 AM	0.07	329	0.07	0.8	15.6	33.8

17-Jun-21 05:35:18 AM	0.07	329	0.07	0.8	15.6	33.8
17-Jun-21 05:36:19 AM	0.07	329	0.07	0.8	15.6	33.8
17-Jun-21 05:37:20 AM	0.07	328	0.07	0.8	15.6	33.8
17-Jun-21 05:38:21 AM	0.07	328	0.07	0.8	15.6	33.9
17-Jun-21 05:39:22 AM	0.07	329	0.07	0.8	15.6	33.9
17-Jun-21 05:40:23 AM	0.07	330	0.07	0.8	15.6	33.9
17-Jun-21 05:41:24 AM	0.07	328	0.07	0.8	15.6	33.9
17-Jun-21 05:42:25 AM	0.07	329	0.07	0.8	15.6	33.9
17-Jun-21 05:43:26 AM	0.07	329	0.07	0.8	15.6	33.9
17-Jun-21 05:44:27 AM	0.07	330	0.07	0.8	15.5	33.9
17-Jun-21 05:45:28 AM	0.07	328	0.07	0.8	15.6	34.0
17-Jun-21 05:46:29 AM	0.07	326	0.07	0.8	15.6	34.0
17-Jun-21 05:47:30 AM	0.07	329	0.07	0.8	15.6	34.0
17-Jun-21 05:48:31 AM	0.07	330	0.07	0.8	15.6	34.0
17-Jun-21 05:49:32 AM	0.07	327	0.07	0.8	15.6	34.0
17-Jun-21 05:50:33 AM	0.07	326	0.07	0.8	15.6	34.0
17-Jun-21 05:51:34 AM	0.07	325	0.07	0.8	15.7	34.0
17-Jun-21 05:52:35 AM	0.07	329	0.07	0.8	15.6	33.9
17-Jun-21 05:53:36 AM	0.07	328	0.07	0.9	15.6	34.0
17-Jun-21 05:54:37 AM	0.07	326	0.07	0.9	15.6	34.0
17-Jun-21 05:55:38 AM	0.07	325	0.07	0.8	15.6	34.0
17-Jun-21 05:56:39 AM	0.07	328	0.07	0.9	15.6	34.0
17-Jun-21 05:57:40 AM	0.07	328	0.07	0.9	15.6	34.0
17-Jun-21 05:58:41 AM	0.07	328	0.07	0.9	15.6	34.0
17-Jun-21 05:59:42 AM	0.07	325	0.07	0.9	15.6	34.0
17-Jun-21 06:00:43 AM	0.07	326	0.07	0.9	15.6	34.1
17-Jun-21 06:01:44 AM	0.07	327	0.07	0.9	15.6	34.1
17-Jun-21 06:02:45 AM	0.07	327	0.07	0.8	15.6	34.1
17-Jun-21 06:03:46 AM	0.07	327	0.07	0.9	15.5	34.1
17-Jun-21 06:04:47 AM	0.07	326	0.07	0.9	15.6	34.2
17-Jun-21 06:05:48 AM	0.07	325	0.07	0.8	15.6	34.2
17-Jun-21 06:06:49 AM	0.07	327	0.07	0.8	15.6	34.2
17-Jun-21 06:07:50 AM	0.07	326	0.07	0.8	15.7	34.2
17-Jun-21 06:08:51 AM	0.07	327	0.07	0.8	15.6	34.2
17-Jun-21 06:09:52 AM	0.07	327	0.07	0.9	15.6	34.2
17-Jun-21 06:10:53 AM	0.07	327	0.07	0.9	15.6	34.2
17-Jun-21 06:11:54 AM	0.07	326	0.07	0.8	15.6	34.3
17-Jun-21 06:12:55 AM	0.07	329	0.07	0.8	15.7	34.3
17-Jun-21 06:13:56 AM	0.07	329	0.07	0.9	15.6	34.3
17-Jun-21 06:14:57 AM	0.07	328	0.07	0.9	15.5	34.3
17-Jun-21 06:15:58 AM	0.07	325	0.07	0.9	15.6	34.4
17-Jun-21 06:16:59 AM	0.07	327	0.07	0.8	15.6	34.4
17-Jun-21 06:18:00 AM	0.07	326	0.07	0.8	15.6	34.4
17-Jun-21 06:19:01 AM	0.07	328	0.07	0.8	15.7	34.4
17-Jun-21 06:20:02 AM	0.07	328	0.07	0.9	15.6	34.4
17-Jun-21 06:21:03 AM	0.07	325	0.07	0.9	15.6	34.4
17-Jun-21 06:22:04 AM	0.07	325	0.07	0.9	15.6	34.4
17-Jun-21 06:23:05 AM	0.07	326	0.08	0.9	15.6	34.5
17-Jun-21 06:24:06 AM	0.07	329	0.07	0.9	15.6	34.5
17-Jun-21 06:25:07 AM	0.07	327	0.07	0.9	15.6	34.4
17-Jun-21 06:26:08 AM	0.07	327	0.07	0.9	15.6	34.5
17-Jun-21 06:27:09 AM	0.07	327	0.07	0.9	15.5	34.6
17-Jun-21 06:28:10 AM	0.07	324	0.07	0.9	15.6	34.7
17-Jun-21 06:29:11 AM	0.07	326	0.07	0.9	15.5	34.7
17-Jun-21 06:30:12 AM	0.07	326	0.07	0.9	15.6	34.7
17-Jun-21 06:31:13 AM	0.07	327	0.07	0.9	15.6	34.7
17-Jun-21 06:32:14 AM	0.07	326	0.07	0.9	15.6	34.7

17-Jun-21 06:33:15 AM	0.07	327	0.07	0.9	15.5	34.7
17-Jun-21 06:34:16 AM	0.07	327	0.07	0.9	15.6	34.8
17-Jun-21 06:35:17 AM	0.07	327	0.07	0.9	15.6	34.8
17-Jun-21 06:36:18 AM	0.07	326	0.07	0.9	15.6	34.8
17-Jun-21 06:37:19 AM	0.07	327	0.07	0.9	15.6	34.8
17-Jun-21 06:38:20 AM	0.07	327	0.07	0.9	15.5	34.7
17-Jun-21 06:39:21 AM	0.07	327	0.07	0.9	15.5	34.8
17-Jun-21 06:40:22 AM	0.07	328	0.07	0.9	15.6	34.8
17-Jun-21 06:41:23 AM	0.07	327	0.07	0.9	15.5	34.8
17-Jun-21 06:42:24 AM	0.07	324	0.07	0.9	15.6	34.8
17-Jun-21 06:43:25 AM	0.07	325	0.07	0.9	15.7	34.8
17-Jun-21 06:44:26 AM	0.07	325	0.07	0.9	15.6	34.7
17-Jun-21 06:45:27 AM	0.07	329	0.07	0.9	15.5	34.7
17-Jun-21 06:46:28 AM	0.07	330	0.07	0.9	15.5	34.7
17-Jun-21 06:47:29 AM	0.07	326	0.07	0.9	15.5	34.8
17-Jun-21 06:48:30 AM	0.07	325	0.07	0.9	15.5	34.9
17-Jun-21 06:49:31 AM	0.07	322	0.07	0.8	15.5	34.9
17-Jun-21 06:50:32 AM	0.07	326	0.08	0.8	15.5	34.9
17-Jun-21 06:51:33 AM	0.07	326	0.07	0.9	15.6	34.9
17-Jun-21 06:52:34 AM	0.07	325	0.07	0.8	15.5	34.8
17-Jun-21 06:53:35 AM	0.07	324	0.07	0.9	15.5	34.8
17-Jun-21 06:54:36 AM	0.07	326	0.07	0.9	15.7	34.8
17-Jun-21 06:55:37 AM	0.07	326	0.07	0.9	15.6	34.7
17-Jun-21 06:56:38 AM	0.07	326	0.07	0.9	15.6	34.7
17-Jun-21 06:57:39 AM	0.07	325	0.07	0.9	15.6	34.7
17-Jun-21 06:58:40 AM	0.07	325	0.07	0.9	15.6	34.7
17-Jun-21 06:59:41 AM	0.07	326	0.07	0.9	15.6	34.7
17-Jun-21 07:00:42 AM	0.07	325	0.08	0.9	15.6	34.7
17-Jun-21 07:01:43 AM	0.07	328	0.08	0.9	15.6	34.7
17-Jun-21 07:02:44 AM	0.07	325	0.08	0.9	15.6	34.7
17-Jun-21 07:03:45 AM	0.07	328	0.08	0.9	15.5	34.7
17-Jun-21 07:04:46 AM	0.07	326	0.08	0.9	15.5	34.8
17-Jun-21 07:05:47 AM	0.07	325	0.08	0.9	15.6	34.8
17-Jun-21 07:06:48 AM	0.07	325	0.08	0.9	15.5	34.7
17-Jun-21 07:07:49 AM	0.07	326	0.08	0.9	15.5	34.7
17-Jun-21 07:08:50 AM	0.07	325	0.08	0.9	15.6	34.7
17-Jun-21 07:09:51 AM	0.07	324	0.07	0.9	15.6	34.7
17-Jun-21 07:10:52 AM	0.07	328	0.08	0.9	15.6	34.6
17-Jun-21 07:11:53 AM	0.07	330	0.08	0.9	15.6	34.6
17-Jun-21 07:12:54 AM	0.07	329	0.08	0.9	15.6	34.6
17-Jun-21 07:13:55 AM	0.07	329	0.08	0.9	15.5	34.6
17-Jun-21 07:14:56 AM	0.07	328	0.08	0.9	15.6	34.7
17-Jun-21 07:15:57 AM	0.07	326	0.08	0.9	15.6	34.6
17-Jun-21 07:16:58 AM	0.07	327	0.08	0.9	15.6	34.7
17-Jun-21 07:17:59 AM	0.07	326	0.08	0.9	15.6	34.7
17-Jun-21 07:19:00 AM	0.07	326	0.08	0.9	15.5	34.7
17-Jun-21 07:20:01 AM	0.07	327	0.08	0.9	15.5	34.8
17-Jun-21 07:21:02 AM	0.07	328	0.08	0.9	15.6	34.8
17-Jun-21 07:22:03 AM	0.07	326	0.08	0.9	15.6	34.8
17-Jun-21 07:23:04 AM	0.07	326	0.08	0.9	15.6	34.8
17-Jun-21 07:24:05 AM	0.07	328	0.08	0.9	15.5	34.8
17-Jun-21 07:25:06 AM	0.07	328	0.08	0.9	15.5	34.9
17-Jun-21 07:26:07 AM	0.07	326	0.08	0.9	15.5	34.9
17-Jun-21 07:27:08 AM	0.07	325	0.08	0.9	15.5	35.0
17-Jun-21 07:28:09 AM	0.07	324	0.08	0.9	15.6	35.0
17-Jun-21 07:29:10 AM	0.07	324	0.08	0.9	15.6	35.0
17-Jun-21 07:30:11 AM	0.07	326	0.08	0.9	15.6	35.0

17-Jun-21 07:31:12 AM	0.07	328	0.08	0.9	15.6	35.0
17-Jun-21 07:32:13 AM	0.07	329	0.08	0.9	15.6	35.1
17-Jun-21 07:33:14 AM	0.07	326	0.08	0.9	15.6	35.1
17-Jun-21 07:34:15 AM	0.07	327	0.08	0.9	15.5	35.1
17-Jun-21 07:35:16 AM	0.07	326	0.08	0.9	15.5	35.2
17-Jun-21 07:36:17 AM	0.07	327	0.08	0.9	15.5	35.3
17-Jun-21 07:37:18 AM	0.07	326	0.08	0.9	15.6	35.4
17-Jun-21 07:38:19 AM	0.07	327	0.08	0.9	15.6	35.3
17-Jun-21 07:39:20 AM	0.07	327	0.08	0.9	15.6	35.3
17-Jun-21 07:40:21 AM	0.07	325	0.08	0.9	15.6	35.3
17-Jun-21 07:41:22 AM	0.07	326	0.08	0.9	15.6	35.3
17-Jun-21 07:42:23 AM	0.07	323	0.08	0.9	15.6	35.3
17-Jun-21 07:43:24 AM	0.07	326	0.08	0.9	15.5	35.4
17-Jun-21 07:44:25 AM	0.07	324	0.08	0.9	15.6	35.5
17-Jun-21 07:45:26 AM	0.07	326	0.08	0.9	15.6	35.6
17-Jun-21 07:46:27 AM	0.07	323	0.08	0.9	15.6	35.6
17-Jun-21 07:47:28 AM	0.07	326	0.08	0.9	15.6	35.5
17-Jun-21 07:48:29 AM	0.07	326	0.08	0.9	15.6	35.6
17-Jun-21 07:49:30 AM	0.07	326	0.08	0.9	15.6	35.7
17-Jun-21 07:50:31 AM	0.07	326	0.08	0.9	15.6	35.6
17-Jun-21 07:51:32 AM	0.07	324	0.08	0.9	15.7	35.7
17-Jun-21 07:52:33 AM	0.07	327	0.08	0.9	15.6	35.6
17-Jun-21 07:53:34 AM	0.07	328	0.08	0.9	15.6	35.6
17-Jun-21 07:54:35 AM	0.07	328	0.08	0.9	15.7	35.7
17-Jun-21 07:55:36 AM	0.07	328	0.08	0.9	15.6	35.6
17-Jun-21 07:56:37 AM	0.07	327	0.08	0.9	15.6	35.7
17-Jun-21 07:57:38 AM	0.07	327	0.08	0.9	15.6	35.7
17-Jun-21 07:58:39 AM	0.07	327	0.08	0.9	15.6	35.8
17-Jun-21 07:59:40 AM	0.07	325	0.08	0.9	15.6	35.9
17-Jun-21 08:00:41 AM	0.07	324	0.08	0.9	15.6	35.9
17-Jun-21 08:01:42 AM	0.07	326	0.08	0.9	15.6	35.9
17-Jun-21 08:02:43 AM	0.08	324	0.08	0.9	15.6	36.0
17-Jun-21 08:03:44 AM	0.08	328	0.08	0.9	15.6	36.0
17-Jun-21 08:04:45 AM	0.08	326	0.08	0.9	15.6	36.0
17-Jun-21 08:05:46 AM	0.08	326	0.08	0.9	15.6	36.0
17-Jun-21 08:06:47 AM	0.08	326	0.08	0.9	15.6	36.0
17-Jun-21 08:07:48 AM	0.08	324	0.08	0.9	15.7	36.0
17-Jun-21 08:08:49 AM	0.08	327	0.08	0.9	15.6	36.0
17-Jun-21 08:09:50 AM	0.07	326	0.08	0.9	15.6	36.0
17-Jun-21 08:10:51 AM	0.08	327	0.08	0.9	15.7	36.0
17-Jun-21 08:11:52 AM	0.08	328	0.08	0.9	15.6	36.0
17-Jun-21 08:12:53 AM	0.08	325	0.08	0.9	15.7	36.1
17-Jun-21 08:13:54 AM	0.08	324	0.08	0.9	15.7	36.1
17-Jun-21 08:14:55 AM	0.08	325	0.08	0.9	15.7	36.1
17-Jun-21 08:15:56 AM	0.08	326	0.08	0.9	15.7	36.1
17-Jun-21 08:16:57 AM	0.08	326	0.08	0.9	15.7	36.0
17-Jun-21 08:17:58 AM	0.08	328	0.08	0.9	15.7	36.0
17-Jun-21 08:18:59 AM	0.08	325	0.08	0.9	15.7	36.1
17-Jun-21 08:20:00 AM	0.08	327	0.08	0.9	15.7	36.1
17-Jun-21 08:21:01 AM	0.08	327	0.08	0.9	15.8	36.2
17-Jun-21 08:22:02 AM	0.08	327	0.08	0.9	15.7	36.1
17-Jun-21 08:23:03 AM	0.08	329	0.08	0.9	15.7	36.1
17-Jun-21 08:24:04 AM	0.08	330	0.08	0.9	15.7	36.2
17-Jun-21 08:25:05 AM	0.08	329	0.09	0.9	15.7	36.3
17-Jun-21 08:26:06 AM	0.08	327	0.09	0.9	15.7	36.4
17-Jun-21 08:27:07 AM	0.08	327	0.09	0.9	15.7	36.4
17-Jun-21 08:28:08 AM	0.08	328	0.08	0.9	15.8	36.5

17-Jun-21 08:29:09 AM	0.08	327	0.09	0.9	15.7	36.4
17-Jun-21 08:30:10 AM	0.08	328	0.09	0.9	15.8	36.6
17-Jun-21 08:31:11 AM	0.08	329	0.09	0.9	15.7	36.5
17-Jun-21 08:32:12 AM	0.08	328	0.09	0.9	15.7	36.6
17-Jun-21 08:33:13 AM	0.08	329	0.09	0.9	15.7	36.6
17-Jun-21 08:34:14 AM	0.08	326	0.09	0.9	15.8	36.6
17-Jun-21 08:35:15 AM	0.08	327	0.09	0.9	15.8	36.6
17-Jun-21 08:36:16 AM	0.08	328	0.09	0.9	15.8	36.7
17-Jun-21 08:37:17 AM	0.08	327	0.08	0.9	15.8	36.6
17-Jun-21 08:38:18 AM	0.08	328	0.09	0.9	15.7	36.6
17-Jun-21 08:39:19 AM	0.08	329	0.09	0.9	15.7	36.6
17-Jun-21 08:40:20 AM	0.08	327	0.09	0.9	15.8	36.8
17-Jun-21 08:41:21 AM	0.08	323	0.08	0.9	15.8	36.7
17-Jun-21 08:42:22 AM	0.08	328	0.08	0.9	15.7	36.6
17-Jun-21 08:43:23 AM	0.08	332	0.09	0.9	15.7	36.6
17-Jun-21 08:44:24 AM	0.08	330	0.08	0.9	15.7	36.7
17-Jun-21 08:45:25 AM	0.08	327	0.08	0.9	15.7	36.7
17-Jun-21 08:46:26 AM	0.08	325	0.08	0.9	15.8	36.8
17-Jun-21 08:47:27 AM	0.08	328	0.09	0.9	15.8	36.9
17-Jun-21 08:48:28 AM	0.08	326	0.09	0.9	15.8	37.1
17-Jun-21 08:49:29 AM	0.08	326	0.09	0.9	15.7	37.1
17-Jun-21 08:50:30 AM	0.08	325	0.09	0.9	15.7	37.2
17-Jun-21 08:51:31 AM	0.08	327	0.09	0.9	15.7	37.2
17-Jun-21 08:52:32 AM	0.08	324	0.08	0.9	15.8	37.4
17-Jun-21 08:53:33 AM	0.08	324	0.09	0.9	15.8	37.3
17-Jun-21 08:54:34 AM	0.08	327	0.09	0.9	15.8	37.3
17-Jun-21 08:55:35 AM	0.08	326	0.09	0.9	15.8	37.3
17-Jun-21 08:56:36 AM	0.08	326	0.08	0.9	15.8	37.3
17-Jun-21 08:57:37 AM	0.08	328	0.08	0.9	15.8	37.3
17-Jun-21 08:58:38 AM	0.08	327	0.09	0.9	15.8	37.4
17-Jun-21 08:59:39 AM	0.08	324	0.08	0.9	15.9	37.5
17-Jun-21 09:00:40 AM	0.08	325	0.09	0.9	15.8	37.5
17-Jun-21 09:01:41 AM	0.08	323	0.09	0.9	15.8	37.6
17-Jun-21 09:02:42 AM	0.08	323	0.09	0.9	15.8	37.6
17-Jun-21 09:03:43 AM	0.08	326	0.08	0.9	15.9	37.6
17-Jun-21 09:04:44 AM	0.08	327	0.08	0.9	15.9	37.5
17-Jun-21 09:05:45 AM	0.08	327	0.09	0.9	15.8	37.4
17-Jun-21 09:06:46 AM	0.08	325	0.08	0.9	15.8	37.4
17-Jun-21 09:07:47 AM	0.08	327	0.09	0.9	15.7	37.4
17-Jun-21 09:08:48 AM	0.08	324	0.08	0.9	15.8	37.5
17-Jun-21 09:09:49 AM	0.08	323	0.08	0.9	15.8	37.5
17-Jun-21 09:10:50 AM	0.08	324	0.08	0.9	15.8	37.6
17-Jun-21 09:11:51 AM	0.08	325	0.08	0.8	15.8	37.7
17-Jun-21 09:12:52 AM	0.08	325	0.08	0.9	15.8	37.7
17-Jun-21 09:13:53 AM	0.08	326	0.08	0.9	15.8	37.6
17-Jun-21 09:14:54 AM	0.08	325	0.08	0.9	15.9	37.5
17-Jun-21 09:15:55 AM	0.08	326	0.08	0.9	15.9	37.5
17-Jun-21 09:16:56 AM	0.08	325	0.08	0.9	15.8	37.5
17-Jun-21 09:17:57 AM	0.08	326	0.09	0.9	15.9	37.6
17-Jun-21 09:18:58 AM	0.08	325	0.08	0.9	15.9	37.7
17-Jun-21 09:19:59 AM	0.08	325	0.08	0.9	15.8	37.6
17-Jun-21 09:21:00 AM	0.08	323	0.08	0.9	15.9	37.7
17-Jun-21 09:22:01 AM	0.08	325	0.08	0.9	15.9	37.6
17-Jun-21 09:23:02 AM	0.08	326	0.08	0.9	15.8	37.5
17-Jun-21 09:24:03 AM	0.08	326	0.08	0.9	15.9	37.6
17-Jun-21 09:25:04 AM	0.08	327	0.08	0.9	15.9	37.7
17-Jun-21 09:26:05 AM	0.08	327	0.08	0.9	15.8	37.7

17-Jun-21 09:27:06 AM	0.08	325	0.08	0.9	15.8	37.8
17-Jun-21 09:28:07 AM	0.08	326	0.08	0.9	15.8	37.9
17-Jun-21 09:29:08 AM	0.08	324	0.08	0.9	15.8	37.9
17-Jun-21 09:30:09 AM	0.08	322	0.08	0.9	15.9	38.0
17-Jun-21 09:31:10 AM	0.08	324	0.08	0.9	15.9	38.0
17-Jun-21 09:32:11 AM	0.08	326	0.08	0.9	15.9	38.0
17-Jun-21 09:33:12 AM	0.08	325	0.08	0.9	15.9	38.0
17-Jun-21 09:34:13 AM	0.08	325	0.08	0.9	15.9	38.0
17-Jun-21 09:35:14 AM	0.08	324	0.09	0.9	15.9	38.1
17-Jun-21 09:36:15 AM	0.08	325	0.09	0.9	15.9	38.1
17-Jun-21 09:37:16 AM	0.08	324	0.09	0.9	15.9	38.2
17-Jun-21 09:38:17 AM	0.08	323	0.09	0.9	15.9	38.3
17-Jun-21 09:39:18 AM	0.08	323	0.09	0.9	15.9	38.2
17-Jun-21 09:40:19 AM	0.08	323	0.09	0.9	15.9	38.2
17-Jun-21 09:41:20 AM	0.08	323	0.09	0.9	15.9	38.2
17-Jun-21 09:42:21 AM	0.08	323	0.09	0.9	15.8	38.2
17-Jun-21 09:43:22 AM	0.08	323	0.09	0.9	15.9	38.4
17-Jun-21 09:44:23 AM	0.08	323	0.09	0.9	15.8	38.4
17-Jun-21 09:45:24 AM	0.08	321	0.09	0.9	15.8	38.4
17-Jun-21 09:46:25 AM	0.08	321	0.09	0.9	15.9	38.5
17-Jun-21 09:47:26 AM	0.08	323	0.09	0.9	15.9	38.5
17-Jun-21 09:48:27 AM	0.08	324	0.09	0.9	15.9	38.5
17-Jun-21 09:49:28 AM	0.08	325	0.09	0.9	15.9	38.5
17-Jun-21 09:50:29 AM	0.08	324	0.09	0.9	15.9	38.5
17-Jun-21 09:51:30 AM	0.08	323	0.09	0.9	15.9	38.4
17-Jun-21 09:52:31 AM	0.08	322	0.09	0.9	16.0	38.5
17-Jun-21 09:53:32 AM	0.08	324	0.09	0.9	16.0	38.4
17-Jun-21 09:54:33 AM	0.08	324	0.09	0.9	15.9	38.4
17-Jun-21 09:55:34 AM	0.08	323	0.09	0.9	15.9	38.5
17-Jun-21 09:56:35 AM	0.08	324	0.09	0.9	16.0	38.4
17-Jun-21 09:57:36 AM	0.08	321	0.09	0.9	16.0	38.5
17-Jun-21 09:58:37 AM	0.08	324	0.09	0.9	16.0	38.4
17-Jun-21 09:59:38 AM	0.08	324	0.09	0.9	16.0	38.4
17-Jun-21 10:00:39 AM	0.08	324	0.09	0.9	16.0	38.4
17-Jun-21 10:01:40 AM	0.08	325	0.09	0.9	16.0	38.4
17-Jun-21 10:02:41 AM	0.08	327	0.09	0.9	16.0	38.4
17-Jun-21 10:03:42 AM	0.08	326	0.09	0.9	16.0	38.4
17-Jun-21 10:04:43 AM	0.08	326	0.09	0.9	16.0	38.3
17-Jun-21 10:05:44 AM	0.08	325	0.09	0.9	16.0	38.3
17-Jun-21 10:06:45 AM	0.08	327	0.09	0.9	15.9	38.2
17-Jun-21 10:07:46 AM	0.08	324	0.09	0.9	15.9	38.2
17-Jun-21 10:08:47 AM	0.08	324	0.09	0.9	16.0	38.4
17-Jun-21 10:09:48 AM	0.08	325	0.09	0.9	16.0	38.4
17-Jun-21 10:10:49 AM	0.08	325	0.09	0.9	16.0	38.4
17-Jun-21 10:11:50 AM	0.08	324	0.09	0.9	15.9	38.4
17-Jun-21 10:12:51 AM	0.08	323	0.09	0.9	16.0	38.5
17-Jun-21 10:13:52 AM	0.08	324	0.09	0.9	15.9	38.4
17-Jun-21 10:14:53 AM	0.08	323	0.09	0.9	15.9	38.4
17-Jun-21 10:15:54 AM	0.08	322	0.09	0.9	15.9	38.3
17-Jun-21 10:16:55 AM	0.08	324	0.09	0.9	15.9	38.3
17-Jun-21 10:17:56 AM	0.08	323	0.09	0.8	15.9	38.3
17-Jun-21 10:18:57 AM	0.08	324	0.09	0.8	15.9	38.3
17-Jun-21 10:19:58 AM	0.08	325	0.09	0.8	15.9	38.2
17-Jun-21 10:20:59 AM	0.08	324	0.09	0.8	15.9	38.2
17-Jun-21 10:22:00 AM	0.08	323	0.09	0.8	15.9	38.1
17-Jun-21 10:23:01 AM	0.08	327	0.09	0.8	16.0	38.1
17-Jun-21 10:24:02 AM	0.08	326	0.09	0.8	16.0	37.9

17-Jun-21 10:25:03 AM	0.08	327	0.09	0.9	15.9	37.8
17-Jun-21 10:26:04 AM	0.08	324	0.09	0.9	15.9	37.8
17-Jun-21 10:27:05 AM	0.08	324	0.09	0.8	15.9	38.0
17-Jun-21 10:28:06 AM	0.08	324	0.09	0.8	15.9	38.0
17-Jun-21 10:29:07 AM	0.08	324	0.09	0.8	15.9	37.9
17-Jun-21 10:30:08 AM	0.08	324	0.09	0.8	15.9	37.9
17-Jun-21 10:31:09 AM	0.08	324	0.09	0.8	15.9	37.9
17-Jun-21 10:32:10 AM	0.08	324	0.09	0.8	16.0	38.1
17-Jun-21 10:33:11 AM	0.08	324	0.09	0.8	16.0	38.1
17-Jun-21 10:34:12 AM	0.08	324	0.09	0.8	15.9	38.1
17-Jun-21 10:35:13 AM	0.08	325	0.09	0.9	15.9	38.1
17-Jun-21 10:36:14 AM	0.08	322	0.09	0.9	15.9	38.1
17-Jun-21 10:37:15 AM	0.08	323	0.09	0.8	15.9	38.1
17-Jun-21 10:38:16 AM	0.08	324	0.09	0.8	15.9	38.2
17-Jun-21 10:39:17 AM	0.08	322	0.09	0.9	15.9	38.1
17-Jun-21 10:40:18 AM	0.08	324	0.09	0.9	15.9	38.2
17-Jun-21 10:41:19 AM	0.08	327	0.09	0.8	15.9	38.3
17-Jun-21 10:42:20 AM	0.08	325	0.09	0.9	16.0	38.2
17-Jun-21 10:43:21 AM	0.08	324	0.09	0.8	16.0	38.1
17-Jun-21 10:44:22 AM	0.08	323	0.09	0.9	16.0	37.9
17-Jun-21 10:45:23 AM	0.08	326	0.09	0.9	16.0	37.9
17-Jun-21 10:46:24 AM	0.08	326	0.09	0.9	16.0	37.9
17-Jun-21 10:47:25 AM	0.08	325	0.09	0.9	16.0	38.0
17-Jun-21 10:48:26 AM	0.08	324	0.09	0.9	16.0	38.0
17-Jun-21 10:49:27 AM	0.08	324	0.09	0.9	16.0	38.1
17-Jun-21 10:50:28 AM	0.08	326	0.09	0.9	16.0	38.0
17-Jun-21 10:51:29 AM	0.08	325	0.09	0.9	16.0	38.0
17-Jun-21 10:52:30 AM	0.08	325	0.09	0.9	15.9	38.0
17-Jun-21 10:53:31 AM	0.08	325	0.09	0.9	16.0	38.0
17-Jun-21 10:54:32 AM	0.08	324	0.09	0.8	16.0	37.9
17-Jun-21 10:55:33 AM	0.08	325	0.09	0.8	15.9	37.8
17-Jun-21 10:56:34 AM	0.08	325	0.09	0.8	15.9	37.9
17-Jun-21 10:57:35 AM	0.08	323	0.09	0.8	15.9	37.9
17-Jun-21 10:58:36 AM	0.08	323	0.09	0.8	15.9	37.9
17-Jun-21 10:59:37 AM	0.08	323	0.09	0.8	16.0	37.9
17-Jun-21 11:00:38 AM	0.08	324	0.09	0.8	15.9	37.8
17-Jun-21 11:01:39 AM	0.08	322	0.09	0.9	15.9	38.0
17-Jun-21 11:02:40 AM	0.08	323	0.09	0.8	15.9	38.0
17-Jun-21 11:03:41 AM	0.08	322	0.09	0.8	15.9	38.0
17-Jun-21 11:04:42 AM	0.08	323	0.09	0.8	15.9	38.0
17-Jun-21 11:05:43 AM	0.08	321	0.09	0.8	16.0	38.0
17-Jun-21 11:06:44 AM	0.08	322	0.09	0.8	15.9	38.0
17-Jun-21 11:07:45 AM	0.08	325	0.09	0.8	15.9	37.9
17-Jun-21 11:08:46 AM	0.08	323	0.09	0.8	15.9	37.9
17-Jun-21 11:09:47 AM	0.08	324	0.09	0.8	15.8	37.9
17-Jun-21 11:10:48 AM	0.08	322	0.09	0.8	15.9	38.0
17-Jun-21 11:11:49 AM	0.08	322	0.09	0.8	15.9	38.0
17-Jun-21 11:12:50 AM	0.08	324	0.09	0.8	15.8	38.0
17-Jun-21 11:13:51 AM	0.08	323	0.09	0.8	15.9	38.1
17-Jun-21 11:14:52 AM	0.08	322	0.09	0.8	15.9	38.2
17-Jun-21 11:15:53 AM	0.08	324	0.09	0.8	15.9	38.2
17-Jun-21 11:16:54 AM	0.08	324	0.09	0.8	15.9	38.1
17-Jun-21 11:17:55 AM	0.08	323	0.09	0.8	16.0	38.1
17-Jun-21 11:18:56 AM	0.08	323	0.09	0.8	15.9	38.0
17-Jun-21 11:19:57 AM	0.08	324	0.09	0.8	16.0	38.0
17-Jun-21 11:20:58 AM	0.08	323	0.09	0.8	15.9	38.0
17-Jun-21 11:21:59 AM	0.08	322	0.09	0.8	15.9	38.1

17-Jun-21 11:23:00 AM	0.08	324	0.09	0.8	15.9	38.2
17-Jun-21 11:24:01 AM	0.08	323	0.09	0.8	15.9	38.2
17-Jun-21 11:25:02 AM	0.08	323	0.09	0.8	15.9	38.2
17-Jun-21 11:26:03 AM	0.08	322	0.09	0.8	15.9	38.3
17-Jun-21 11:27:04 AM	0.08	323	0.09	0.8	16.0	38.3
17-Jun-21 11:28:05 AM	0.08	327	0.09	0.8	15.9	38.3
17-Jun-21 11:29:06 AM	0.08	326	0.09	0.8	16.0	38.3
17-Jun-21 11:30:07 AM	0.08	323	0.09	0.8	15.9	38.3
17-Jun-21 11:31:08 AM	0.08	323	0.09	0.9	15.9	38.4
17-Jun-21 11:32:09 AM	0.08	324	0.09	0.8	16.0	38.3
17-Jun-21 11:33:10 AM	0.08	324	0.09	0.8	16.0	38.4
17-Jun-21 11:34:11 AM	0.08	322	0.09	0.8	16.0	38.5
17-Jun-21 11:35:12 AM	0.08	323	0.09	0.8	16.0	38.4
17-Jun-21 11:36:13 AM	0.08	322	0.09	0.8	16.0	38.4
17-Jun-21 11:37:14 AM	0.08	323	0.09	0.8	16.0	38.4
17-Jun-21 11:38:15 AM	0.08	323	0.09	0.8	16.0	38.4
17-Jun-21 11:39:16 AM	0.08	326	0.09	0.9	16.0	38.3
17-Jun-21 11:40:17 AM	0.08	324	0.09	0.8	15.9	38.3
17-Jun-21 11:41:18 AM	0.08	321	0.09	0.8	16.0	38.4
17-Jun-21 11:42:19 AM	0.08	321	0.09	0.8	16.0	38.5
17-Jun-21 11:43:20 AM	0.08	325	0.09	0.8	16.0	38.5
17-Jun-21 11:44:21 AM	0.08	325	0.09	0.8	16.0	38.5
17-Jun-21 11:45:22 AM	0.08	326	0.09	0.8	16.0	38.5
17-Jun-21 11:46:23 AM	0.08	323	0.09	0.8	16.0	38.5
17-Jun-21 11:47:24 AM	0.08	322	0.09	0.8	16.0	38.6
17-Jun-21 11:48:25 AM	0.08	324	0.09	0.8	16.0	38.4
17-Jun-21 11:49:26 AM	0.08	324	0.09	0.8	15.9	38.5
17-Jun-21 11:50:27 AM	0.08	325	0.09	0.9	16.0	38.5
17-Jun-21 11:51:28 AM	0.08	323	0.09	0.8	16.0	38.5
17-Jun-21 11:52:29 AM	0.08	325	0.09	0.8	16.0	38.4
17-Jun-21 11:53:30 AM	0.08	324	0.09	0.8	16.0	38.5
17-Jun-21 11:54:31 AM	0.08	325	0.09	0.8	16.0	38.5
17-Jun-21 11:55:32 AM	0.08	325	0.09	0.8	16.0	38.5
17-Jun-21 11:56:33 AM	0.08	325	0.09	0.8	16.0	38.5
17-Jun-21 11:57:34 AM	0.08	324	0.09	0.8	15.9	38.5
17-Jun-21 11:58:35 AM	0.08	325	0.09	0.9	16.0	38.6
17-Jun-21 11:59:36 AM	0.08	323	0.09	0.8	16.0	38.6
17-Jun-21 12:00:37 PM	0.08	324	0.09	0.8	16.0	38.7
17-Jun-21 12:01:38 PM	0.08	323	0.09	0.8	16.0	38.7
17-Jun-21 12:02:39 PM	0.08	325	0.09	0.8	16.0	38.8
17-Jun-21 12:03:40 PM	0.08	324	0.09	0.8	16.0	38.9
17-Jun-21 12:04:41 PM	0.08	323	0.09	0.8	16.0	38.9
17-Jun-21 12:05:42 PM	0.08	324	0.09	0.8	16.0	38.9
17-Jun-21 12:06:43 PM	0.08	324	0.09	0.8	16.0	38.9
17-Jun-21 12:07:44 PM	0.08	322	0.09	0.9	16.0	39.0
17-Jun-21 12:08:45 PM	0.08	322	0.09	0.8	16.0	38.9
17-Jun-21 12:09:46 PM	0.08	324	0.09	0.8	16.0	38.8
17-Jun-21 12:10:47 PM	0.08	323	0.09	0.8	16.0	38.8
17-Jun-21 12:11:48 PM	0.08	322	0.09	0.8	16.0	38.8
17-Jun-21 12:12:49 PM	0.08	321	0.09	0.8	16.0	38.9
17-Jun-21 12:13:50 PM	0.08	324	0.09	0.8	16.1	38.8
17-Jun-21 12:14:51 PM	0.08	326	0.09	0.8	16.1	38.7
17-Jun-21 12:15:52 PM	0.08	327	0.09	0.8	16.0	38.7
17-Jun-21 12:16:53 PM	0.08	325	0.09	0.9	15.9	38.6
17-Jun-21 12:17:54 PM	0.08	324	0.09	0.8	16.0	38.7
17-Jun-21 12:18:55 PM	0.08	327	0.09	0.8	16.0	38.7
17-Jun-21 12:19:56 PM	0.08	325	0.09	0.8	16.0	38.6

17-Jun-21 12:20:57 PM	0.08	324	0.09	0.8	16.0	38.7
17-Jun-21 12:21:58 PM	0.08	323	0.09	0.8	16.0	38.6
17-Jun-21 12:22:59 PM	0.08	324	0.09	0.8	16.0	38.7
17-Jun-21 12:24:00 PM	0.08	323	0.09	0.8	16.0	38.8
17-Jun-21 12:25:01 PM	0.08	324	0.09	0.8	16.0	38.7
17-Jun-21 12:26:02 PM	0.08	324	0.09	0.9	15.9	38.7
17-Jun-21 12:27:03 PM	0.08	325	0.09	0.9	16.0	38.8
17-Jun-21 12:28:04 PM	0.08	324	0.09	0.8	16.0	38.8
17-Jun-21 12:29:05 PM	0.08	325	0.09	0.8	16.0	38.7
17-Jun-21 12:30:06 PM	0.08	326	0.09	0.8	16.0	38.9
17-Jun-21 12:31:07 PM	0.08	323	0.09	0.8	16.0	38.9
17-Jun-21 12:32:08 PM	0.08	323	0.09	0.9	16.0	38.9
17-Jun-21 12:33:09 PM	0.08	326	0.09	0.9	16.0	38.8
17-Jun-21 12:34:10 PM	0.08	325	0.09	0.9	16.0	38.8
17-Jun-21 12:35:11 PM	0.08	323	0.09	0.8	16.0	38.8
17-Jun-21 12:36:12 PM	0.08	326	0.09	0.8	16.0	38.9
17-Jun-21 12:37:13 PM	0.08	326	0.09	0.9	16.0	38.9
17-Jun-21 12:38:14 PM	0.08	324	0.09	0.8	16.0	38.9
17-Jun-21 12:39:15 PM	0.08	323	0.09	0.8	16.0	38.9
17-Jun-21 12:40:16 PM	0.08	324	0.09	0.8	15.9	38.8
17-Jun-21 12:41:17 PM	0.08	323	0.09	0.8	16.0	38.8
17-Jun-21 12:42:18 PM	0.08	324	0.09	0.8	15.9	38.9
17-Jun-21 12:43:19 PM	0.08	325	0.09	0.8	15.9	38.9
17-Jun-21 12:44:20 PM	0.08	325	0.09	0.8	16.0	39.0
17-Jun-21 12:45:21 PM	0.08	323	0.09	0.8	15.9	39.1
17-Jun-21 12:46:22 PM	0.08	340	0.09	0.8	16.1	39.7
17-Jun-21 12:47:23 PM	0.08	356	0.09	0.8	16.2	39.9
17-Jun-21 12:48:24 PM	0.08	367	0.09	0.8	16.4	39.8
17-Jun-21 12:49:25 PM	0.08	381	0.09	0.9	16.4	39.6
17-Jun-21 12:50:26 PM	0.08	388	0.09	0.9	16.4	39.4
17-Jun-21 12:51:27 PM	0.08	398	0.09	0.9	16.5	39.3
17-Jun-21 12:52:28 PM	0.08	403	0.09	1.0	16.4	39.2
17-Jun-21 12:53:29 PM	0.08	414	0.09	1.0	16.5	39.2
17-Jun-21 12:54:30 PM	0.09	424	0.09	1.0	16.5	39.1
17-Jun-21 12:55:31 PM	0.08	429	0.09	1.0	16.6	39.0
17-Jun-21 12:56:32 PM	0.08	433	0.09	1.0	16.7	38.9
17-Jun-21 12:57:33 PM	0.08	441	0.09	1.0	16.8	38.7
17-Jun-21 12:58:34 PM	0.08	446	0.09	1.0	16.8	38.5
17-Jun-21 12:59:35 PM	0.08	457	0.09	1.0	16.7	38.3
17-Jun-21 01:00:36 PM	0.08	459	0.09	1.0	16.7	38.1
17-Jun-21 01:01:37 PM	0.08	467	0.08	1.0	16.7	38.1
17-Jun-21 01:02:38 PM	0.08	474	0.08	1.0	16.7	38.1
17-Jun-21 01:03:39 PM	0.08	476	0.08	1.0	16.8	38.1
17-Jun-21 01:04:40 PM	0.08	479	0.08	1.0	16.8	38.1
17-Jun-21 01:05:41 PM	0.08	483	0.08	1.0	16.9	38.1
17-Jun-21 01:06:42 PM	0.08	489	0.08	1.0	17.0	38.0
17-Jun-21 01:07:43 PM	0.08	496	0.08	1.0	16.9	37.9
17-Jun-21 01:08:44 PM	0.08	498	0.08	1.0	16.9	37.9
17-Jun-21 01:09:45 PM	0.08	505	0.08	1.0	17.0	37.9
Average	0.07	361.57	0.07	0.91	18.24	34.27
Max	0.13	748.00	0.09	1.50	28.90	39.90
Min	0.06	321.00	0.03	0.40	15.50	29.30

Appendix B

Semi-structured short interviews were conducted with interior materials retailers (n=30) to check their knowledge about the availability and properties of EFIM materials if existed in their store.

Questions:

Q1: Do you retail EFIMs?

- If they answered 'Yes', they were asked to describe its properties.
- If they answered 'No' and they retail EFIMs, they were shown the materials and clarified reasons for considering this material as EFIMs.
- If they answered 'No' and they did not retail EFIMs in their store, they were asked about reasons for not retailing EFIMs.

Q2: Do customers request EFIMs?

Q3: Do you think that there is a need for EFIMs?

Q4: Do you encourage customers to purchase EFIMs (if available in store)?

Q5: Do you think the health benefits of using EFIMs are widely recognized?

Q6: Do you think the environmental benefits of using EFIMs are widely recognized?

Q7: What are the barriers facing clients while selecting EFIMs?

Appendix C

Semi structure interviews with a combination of open and closed questions were conducted with five Interior designers, having different experience years, to determine their knowledge about Eco-Friendly Interior Materials (EFIMs), their availability, and whether they are requested by clients and applied in their interior design projects.

Q1: Are EFIMs available in Bahrain local market?

Q2: Do you use EFIMs in your interior projects? Why?

Q3: Do customers request EFIMs?

Q4: Do you think that clients are aware about the importance of EFIMs?

Q5: What are the barriers facing clients while selecting EFIMs?

Appendix D

Gray Wolf Sensing Solutions Calibration Certificate

Certificate # 52687

Order Details

Newtech International WLL
P.O. Box No. 54005 Flat #107, Bldg 1501, Road 2116
Manama
321
BAHRAIN

Invoice # E18532
Contact: Felix Anbarasan

Probe Details

Model # IQ610
Serial # 05-3007

Date: 29-Nov-22
ID: 34369

Calibration Details

Sensor	Bar Code/ID	Set Point	Verified	Error	Uncertainty
TVOC	143790226	10ppb	10ppb	0ppb	0.19 %
		8,000ppb	8,000ppb	0ppb	1.01 %
Carbon Dioxide	B1024909	384ppm	391ppm	7ppm	1.83 %
		1,241ppm	1,239ppm	-1ppm	0.71 %
Ozone	214530917021	0.00ppm	-0.01ppm	-0.01ppm	2.35 %
		0.84ppm	0.84ppm	0.00ppm	3.09 %
Carbon Monoxide	11613551021	0.0ppm	-0.1ppm	-0.1ppm	0.47 %
		95.5ppm	95.5ppm	0.0ppm	0.69 %
PT100	Pt001	20.0°C	20.0°C	0.0°C	1.42 %
		40.0°C	40.0°C	0.0°C	0.80 %
Relative Humidity	Rh001	10.0%RH	10.2%RH	0.2%RH	1.40 %
		75.0%RH	75.1%RH	0.1%RH	1.41 %

Temperature calibration performed in moving air at 1m/sec.

All test equipment and/or reference materials used in calibration are fully traceable to recognized national standards.

The uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%.

Lab Ambient Conditions

Temperature 21.4C

Humidity 57.3%RH

Pressure 1008.00mbar

Calibrated By: Gary Le Gear

Date: 29-Nov-22

Facility: Annacotty
GrayWolf Sensing Solutions LTD
Annacotty Business Park
Unit 1C
Annacotty
Co Limerick
IRELAND



Appendix E

 Hal Technology		Certificate No.: 20220512-09		
CERTIFICATE OF CALIBRATION AND TESTING				
Model HAL-HFX205		Serial Number 2052205025		
Description HAL-HFX205 Handheld Formaldehyde Meter (0-10ppm)				
Calibration Method Constant vapor pressure generated from an aqueous solution following the guideline published by US Environmental Protection Agency				
Calibration Verification Results				
NO.	Calibration Standard	Instrument Output	Differences	Environmental Conditions
1	Zero air	0.00 ppm	+0.00 ppm	Temperature: 23°C Relative humidity: 41% Pressure: 972 Pa
2	1.00ppm Standard Fluid	1.00 ppm	+0.00 ppm	
<i>Hal Technology does hereby certify that all the materials, component, and workmanship used in manufacture of this equipment are in strict accordance with the applicable specifications agreed upon by Hal Technology and the customer and with all published specifications. All performance and acceptance tests required under this contract were successfully conducted according to required specifications at the time of testing.</i>				
Calibrated by 		Cal Date 5-12-2022 Due Date 5-12-2023		
On behalf of HAL Technology, LLC				
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خلاصة الدراسة

في السنوات الأخيرة، كان هناك اتجاه ملحوظ في قطاع التصميم الداخلي نحو إنشاء بيئات داخلية تعطي الأولوية للصحة والاستدامة. يعتمد هذا التوجه، المسمى بالتصميم الداخلي البيئي المستدام (ESID)، بشكل كبير على الاختيار الدقيق للمواد الداخلية الصديقة للبيئة (EFIMs) والنباتات الداخلية المناسبة. وبالتالي، أجريت الدراسة على EFIMs المتاحة في السوق المحلية في البحرين. فقد تم اختيار عينة من 30 متجرًا محليًا توفر مواد التشطيب الداخلي للدراسة. تم جمع البيانات من خلال خمس طرق. أولاً، مراجعة EFIMs الموجودة. ثانياً، تم ملاحظة توفر EFIMs من خلال نهج غير مشارك. ثالثاً، تم إجراء مسح لمصممي الديكور الداخلي المحليين. تم جمع البيانات ومعالجتها باستخدام برنامج Microsoft Excel. في سياق المعالجة النباتية، تم إجراء تجارب تنقية الفورمالدهيد من خلال اختيار ثلاثة نباتات داخلية غير محلية وهي *Epipremnum aureum* (نبات البوتوس)، و *Chlorophytum comosum* (نبات العنكبوت)، و *Spathiphyllum wallisii* (زنبق السلام). تم استخدام أجهزة الاستشعار وأجهزة الاستشعار المباشر IQ-610. تمت معالجة البيانات وتم إجراء تحليل إحصائي (اختبار ANOVA) للبيانات. تظهر نتائج دراسة EFIMs أن 70% من الموردين لديهم مخزون من EFIMs بإجمالي ثلاثة وستين EFIMs تم جمعها وتحديدها. من بينها، تم تصنيف 67% من EFIMs على أنها تشطيبات للأرضيات تليها تشطيبات الجدران (25%). وتشطيبات السقف (8%). لم يستخدم غالبية مصممي الديكور الداخلي (80%) الذين تمت مقابلتهم EFIMs وذكروا أن عملائهم لم يطلبوا EFIMs لمشاريعهم. اتفق جميع مصممي الديكور الداخلي الذين تمت مقابلتهم على أن العملاء ليسوا على دراية بأهمية EFIMs. كما كشفت نتائج تجارب معالجة الفورمالدهيد لنباتات الأصص الداخلية الفردية أن النبات الأكثر كفاءة كان *S. wallisii*، يليه *E. aureum*، و *C. comosum* بنسبة 73.0 و 71.5 و 71% على التوالي. بينما كشفت معالجة الفورمالدهيد لنباتات الأصص الثنائية أن النبات الأكثر كفاءة كان *E. aureum*، يليه *S. wallisii*، و *C. comosum* بنسبة 77.5 و 74.6 و 73.0% على التوالي. يوصى بتصميم وتوريد EFIMs بشكل مستمر، كما يوصى بإنشاء برامج توعية للجمهور، وإدراج معرفة EFIMs في المناهج التعليمية. كما يوصى مصممو الديكور الداخلي بالبحث عن EFIMs الحديثة وتطبيقها في مشاريعهم. كما يوصى باختبار نباتات مماثلة في بيئات حقيقية لفترة طويلة وتعريضها لملوثات هواء مختلفة.